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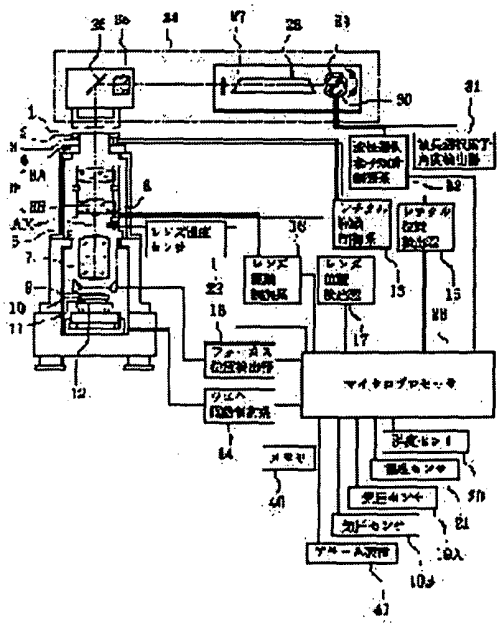
(54) ALIGNER, ALIGNER SYSTEM, AND MANUFACTURE OF DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To discriminate abnormal values due to the faults of the measurement means of an aligner from the those caused by external factors, when its measurement means for atmospheric pressure, etc., indicate abnormal values, by referring the abnormal- operation preventing means of the exposure apparatus to the measured results of a measurement object in other exposure apparatuses too, and by preventing the expo sure apparatus from operating in an abnormal state.

SOLUTION: By checking the fluctuating amounts of atmospheric pressures measured in a short term, barometers 19A, 19B are so set as to deem them as being abnormal, when they exceed a fixed value. That is, when deciding this abnormality, by using the difference between the measured values by the two barometers 19A, 19B in a projective exposure apparatus and using the difference between the atmospheric pressure values measured in the present time and in the last time, whether the fluctuations of the measured values of the atmospheric pressure are caused by the faults of the barometers 19A, 19B themselves or by external factors is decided. Then, when the faults of the barometers 19A, 19B themselves, by substituting the atmospheric pressure value of another exposure apparatus for the one of this exposure apparatus in a fixed term or temporarily, the corrections of its focal position and its magnification are performed to enable continuing of its processing.



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CLAIMS

[Claim(s)]
[Claim 1] It is the aligner which sets to the aligner equipped with a measurement means measure about the predetermined measuring object in equipment, and an unusual operation prevention means prevent that equipment operates under an unusual state based on this measurement result, and is characterized by for the aforementioned unusual operation prevention means to be what prevents operation in the unusual state of the aforementioned equipment also with reference to the measurement result in other equipments about the aforementioned measuring object.
[Claim 2] Both equipment besides the above is an aligner according to claim 1 characterized by being management equipment which manages the aligner contained in the aligner of the others which constitute the computer network, or its network.
[Claim 3] The aforementioned unusual operation prevention means is an aligner according to claim 2 characterized by being what refers to the newest measurement result about the aforementioned measuring object which the aforementioned management equipment acquires from the aligner contained in the aforementioned network by the own measurement means, and is held.
[Claim 4] It is the aligner according to claim 3 characterized by being what performs amendment of the projection scale factor and focal position for [in a position / atmospheric pressure is contained in the aforementioned measuring object, and / supply of the measurement result about the atmospheric pressure of the newest / equipment / management / aforementioned] / the aforementioned unusual operation prevention means is received, and / exposure based on it.
[Claim 5] The measurement result which receives the aforementioned supply is an aligner according to claim 4 characterized by taking into consideration **** between the aligners contained in the aforementioned network.
[Claim 6] The aforementioned measurement means is an aligner according to claim 4 or 5 which measures atmospheric pressure, and is characterized by being what receives supply of the aforementioned measurement result as the alternative when it is what the aforementioned unusual operation prevention means has the unusual measurement result of the atmospheric pressure by the aforementioned measurement means, and the abnormality depends on the aforementioned measurement means.
[Claim 7] An aligner given in any 1 term of the claims 2-6 characterized by having a transmitting means to transmit the measurement result about the aforementioned measuring object to the aforementioned management equipment.
[Claim 8] The aforementioned transmitting means is an aligner according to claim 7 characterized by being what transmits including the number and measurement time of equipment on the occasion of transmission of the aforementioned measurement result.
[Claim 9] An aligner given in any 1 term of the claims 1-8 characterized by containing vacuum ** for adsorbing atmospheric pressure, temperature, humidity, or an exposed substrate, and holding it at the time of exposure in the aforementioned measuring object.
[Claim 10] The aforementioned unusual operation prevention means is an aligner given in any 1 term of

the claims 1-9 characterized by having a malfunction detection means to detect abnormalities based on the measurement result by the aforementioned measurement means.
[Claim 11] The aforementioned measurement means is an aligner according to claim 10 characterized by being what either of the measurement means judges to be unusual when it is two measurement meanses to measure about the measuring object of the same kind and the aforementioned malfunction detection means exceeds the range of predetermined in the difference of the measured value by these measurement meanses.
[Claim 12] The aforementioned malfunction detection means is an aligner according to claim 10 or 11 characterized by being what judged that the aforementioned measurement means is unusual when the difference of this measurement result by the aforementioned measurement means and the last measurement result before a predetermined period is over the predetermined range.
[Claim 13] The aforementioned unusual operation prevention means is an aligner given in any 1 term of the claims 10-12 characterized by being what performs the output or display of a warning to that effect or an error when the aforementioned malfunction detection means detects abnormalities.
[Claim 14] The aforementioned malfunction detection means is an aligner given in any 1 term of the claims 10-13 characterized by being what detects the aforementioned abnormalities based on the measurement result about the measuring object by the aforementioned measurement means, and the measurement result about the aforementioned measuring object in other aligners of the same kind on the computer network to which equipment belongs, and the measuring object of the same kind.
[Claim 15] The aligner of the aforementioned homotypic is installed in the same clean room. the aforementioned malfunction detection means The measurement result by the aforementioned measurement means in equipment, and the measuring object of the same kind in the aligner of the aforementioned homotypic, Or when the measurement result about the measuring object of the same kind in the environmental control equipment which controls the environment of the aforementioned clean room further shows an unusual change similarly, they are the abnormalities besides equipment. It is the aligner according to claim 14 characterized by being the thing in the interior of equipment judged to be unusual when only the measurement result by the aforementioned measurement means in equipment shows an unusual change.
[Claim 16] [when / in / the interior of the aforementioned equipment / in the aforementioned malfunction detection means] judging that it is unusual When the measurement result by two or more aforementioned measurement meanses about the different measuring object relevant to mutual [in equipment] shows an unusual change similarly It is the aligner according to claim 15 characterized by being what judged that the portion in the equipment related to those measurement meanses is unusual, and the measurement means is unusual when only the measurement result by one measurement means shows an unusual change.
[Claim 17] It is the aligner system characterized by to provide a registration means the aforementioned management equipment receives the measurement value in a directions means to direct the measurement about the predetermined candidate for measurement to each aligner, and each aligner measured according to this in the aligner system equipped with the management equipment which manages the aligner and this which constitute the computer network, and register.
[Claim 18] The aforementioned management equipment is an aligner system according to claim 17 characterized by having a means to ask for **** of the measurement value between each projection aligner based on the measurement value of each registered aligner.
[Claim 19] The aforementioned management equipment is an aligner system according to claim 17 or 18 characterized by being what transmits the newest thing of the measurement values registered by the aforementioned registration means from each aligner according to this when there is an inquiry of the newest measurement value about the aforementioned candidate for measurement to the aligner.
[Claim 20] The aforementioned management equipment is an aligner system according to claim 19 characterized by being what extracts the newest aforementioned measurement value based on the information on the measurement time which is made to accompany the aforementioned measurement value and has been registered.

[Claim 21] The aforementioned management equipment is an aligner system according to claim 19 or 20 characterized by being what transmits the measurement value in consideration of **** between each aligner obtained from the measurement value which has carried out [aforementioned] registration in case the aforementioned measurement value is transmitted.
[Claim 22] It is the aligner system characterized by being what is equipped with a measurement means by which the aforementioned management equipment measures about the predetermined measuring object in the aligner system equipped with the management equipment which manages the aligner and this which constitute the computer network, and transmits the measurement result by this measurement means to each aligner through the aforementioned network.
[Claim 23] The aforementioned management equipment is an aligner system according to claim 22 characterized by the ability of whether the aforementioned transmission is performed by which method of these by always transmitting the aforementioned measurement result to each aligner as opposed to the aligner when there is an inquiry of the measurement result about the aforementioned measuring object from each aligner to set up.
[Claim 24] The aforementioned aligner is an aligner system given in any 1 term of the claims 17-23 characterized by being one aligner of the claims 1-16.
[Claim 25] The device manufacture method characterized by to prevent operation in the unusual state of the aforementioned aligner also with reference to the measurement result in other aligner or other equipments about the aforementioned measuring object in the device manufacture method of manufacturing a device by exposing by the aforementioned aligner, preventing measuring about the predetermined measuring object in an aligner, and the aforementioned aligner operating under an unusual state based on this measurement result.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention measures about the predetermined measuring object in equipment, and equipment is related with the device manufacture method that the aligner system and these which have the aligner which prevented operating under an unusual state, and this can be used, based on this measurement result.
[0002]
[Description of the Prior Art] In recent years, according to the demand to high integration of semiconductor devices, such as IC and LSI, the high integration is gathering acceleration increasingly. The circuit pattern image of a mask (reticle) is formed on a sensitization substrate by the projection optical system, and various improvement for improvement in resolution is made also in the reduced type projection aligner (stepper) which exposes a sensitization substrate by the step-and-repeat method.
[0003] the optical-character ability (an image formation scale factor and image formation performance) of the projection optical system which carries out reduction projection of the pattern on a reticle side on a wafer side is variously boiled by the environmental variation, for example, an allobar, and changes In the projection aligner as which the latest high resolution is requested, the error of the optical-character ability generated by change of atmospheric pressure serves as a big trouble, and it is important to amend and project the error of this optical-character ability.
[0004] In order to solve this, it sets to JP,06-342755,A. The table on which a semiconductor wafer is laid, lighting optical system, and the reticle which has a desired imprint pattern, The projection optical system which consists of a lens group containing two or more lenses, and projects the aforementioned imprint pattern on one principal plane of the aforementioned semiconductor wafer, The scale-factor adjustment mechanism in which the projection scale factor of the aforementioned imprint pattern to the aforementioned semiconductor wafer is adjusted by moving the aforementioned lens by the side of the aforementioned reticle or the aforementioned reticle in the aforementioned projection optical system, It is the reduction projection exposure method using the reduction projection aligner which has the focal justification mechanism in which the focal position to the aforementioned semiconductor wafer of the aforementioned projection optical system is adjusted. According to the 1st phase of detecting change of atmospheric pressure or the environmental atmospheric pressure of the aforementioned reduction projection aligner, and the focal justification mechanism in which the distance of the aforementioned projection optical system and the aforementioned table is relatively changed according to change of the aforementioned atmospheric pressure or environmental atmospheric pressure The 2nd phase of performing operation of adjusting the focal position to the aforementioned semiconductor wafer of the aforementioned projection optical system independently of adjustment operation of the aforementioned projection scale factor by the aforementioned scale-factor adjustment mechanism, The projection exposure method characterized by the bird clapper from the 3rd phase which imprints the aforementioned imprint pattern of the aforementioned reticle to the aforementioned semiconductor wafer is proposed.

[0005] Moreover, it sets to JP,08-305034,A. In the equipment which projects the pattern of the 1st body on the 2nd body by the projection optical system An atmospheric pressure detection means to detect change of the atmospheric pressure relevant to the aforementioned projection optical system, and a wavelength change means to change the wavelength of the light used for projection of the pattern of the 1st body of the above, change of the relative index of refraction of the ** material of the aforementioned projection optical system undergo the output of the aforementioned atmospheric pressure detection means, and according to change of the aforementioned atmospheric pressure -- an amendment -- the projection exposure method characterized by having a wavelength change means to change the wavelength of the light used for projection of the pattern of the 1st body of the above like is proposed By these methods, it can amend good by using the atmospheric pressure measurement means and the adjustment mechanism which an everyday atmospheric pressure change and change of the optical-character ability corresponding to the atmospheric pressure of an installation were set up appropriately, in case the pattern on a reticle side is projected on a wafer side by the projection optical system, and the manufacture method of a device using the projection aligner and it from which high optical-character ability is obtained easily can be attained.

[0006]

[Problem(s) to be Solved by the Invention] However, by factors, such as an electric noise, an atmospheric pressure measurement means to offer the information which serves as a basis when deciding the amount of amendments malfunctions, and sometimes measures outlying observation rarely. It is not noticed, but if a projection aligner amends a focal position and a projection scale factor using a focus control mechanism or a scale-factor adjustment mechanism based on the outlying observation which the atmospheric pressure measurement means measured, the problem that the pattern imprinted to the semiconductor wafer will be poor will occur. Moreover, since a semiconductor aligner is very complicated and precise equipment, when exposing a semiconductor, it needs to maintain environment, such as temperature in equipment, and humidity, within fixed limits besides atmospheric pressure. Then, although it has judged that a certain abnormalities occurred to equipment when those environmental values become uniformly out of range conventionally, environmental values, such as atmospheric pressure and temperature, are not necessarily failures of the equipment concerned, though the weather, clean room environment, etc. may receive the environmental influence besides equipment and become outlying observation. In this case, it is difficult to make being based on change of the environment besides equipment judgment whether to be unusual or not in the present condition.

[0007] In order it prevents operation of the equipment in an unusual state to the 1st in an aligner, an aligner system, and the device manufacture method in view of the trouble of the above-mentioned conventional technology, the purpose of this invention is to distinguish the case where it is what the outlying observation depends on failure of a measurement means, and enable it to distinguish the case where it is failure of other portions of equipment further, when measurement meanses, such as atmospheric pressure, showed outlying observation. It is in enabling it to continue device manufacture, without 2nd stopping operation of equipment, even when outlying observation is what is depended on failure of a measurement means.

[0008]

[Means for Solving the Problem] In order to attain this purpose the aligner of this invention In the aligner equipped with a measurement means to measure about the predetermined measuring object in equipment, and an unusual operation prevention means to prevent that equipment operates under an unusual state based on this measurement result The aforementioned unusual operation prevention means is characterized by being what prevents operation in the unusual state of the aforementioned equipment also with reference to the measurement result in other equipments about the aforementioned measuring object. In this composition, when a measurement means shows unusual measured value, the cause is judged also with reference to the measurement result in other equipments, and continuation of operation under an unusual state is prevented based on this result. Therefore, that to which outlying observation originates in equipment itself, the thing to depend on the cause besides equipment is judged appropriately, and when outlying observation is caused unusually [the measurement means of

equipment], correspondence suitable [of continuing operation as an alternative value using the measurement result in other equipments] is made.
[0009] Moreover, in the aligner system equipped with the management equipment which manages the aligner and this from which the aligner system of this invention constitutes the computer network, the aforementioned management equipment is characterized by to provide a directions means to direct the measurement about the predetermined candidate for measurement to each aligner, and a registration means receive and register the measurement value in each aligner measured according to this. In this composition, management equipment acquires from each aligner and the registered measurement value is used with a various form. For example, when the measurement value about the predetermined candidate for measurement in a certain aligner is unusual, the registered newest measurement value is supplied to the aligner as the alternative value. Or based on the registered measured value, it is judged exactly whether it is that to which the unusual measurement value about the predetermined candidate for measurement in a certain aligner originates in the equipment.
[0010] Moreover, another aligner system of this invention is characterized by the aforementioned management equipment being what is equipped with a measurement means to measure about the predetermined measuring object, and transmits the measurement result by this measurement means to each aligner through the aforementioned network in the aligner system equipped with the management equipment which manages the aligner and this which constitute the computer network. In this composition, when the measurement value about the predetermined candidate for measurement in a certain aligner is unusual, the newest measurement value measured in management equipment as the alternative value is supplied to the aligner, and, thereby, the aligner continues operation.
[0011] Moreover, the device manufacture method of this invention measures about the predetermined measuring object in an aligner, and it is characterized by to prevent operation in the unusual state of the aforementioned aligner also with reference to the measurement result in other aligner or other equipments about the aforementioned measuring object in the device manufacture method of manufacturing a device, by exposing by the aforementioned aligner, preventing that the aforementioned aligner operates under an unusual state based on this measurement result. Also in this composition, like the aligner of this invention, that to which outlying observation originates in equipment itself, the thing to depend on the cause besides equipment is judged appropriately, and when outlying observation is caused unusually [the measurement means of equipment], correspondence suitable [of continuing operation as an alternative value using the measurement result in other equipments] is made.
[0012]
[Embodiments of the Invention] In the desirable operation form in the aligner of this invention, both equipment besides the above is management equipment which manages the aligner contained in the aligner of the others which constitute the computer network, or its network, and refer to the newest measurement result about the aforementioned measuring object which management equipment acquires from the aligner contained in the aforementioned network by the own measurement means, and is held for an unusual operation prevention means. Atmospheric pressure is contained in the measuring object, and an unusual operation prevention means receives supply of the measurement result about the newest atmospheric pressure from management equipment, and performs amendment of the projection scale factor for exposure, and a focal position based on it. **** between the aligners in which the measurement result which receives supply in that case is included in a network is taken into consideration. A measurement means measures atmospheric pressure, the unusual operation prevention means has the unusual measurement result of the atmospheric pressure, and when it is what the abnormality depends on a measurement means, it receives supply of the aforementioned measurement result as an alternative value of the unusual measurement result. Moreover, it has a transmitting means to transmit the measurement result about the measuring object to management equipment, and this transmitting means transmits on the occasion of transmission of a measurement result including the number and measurement time of equipment. Vacuum ** for adsorbing others, temperature, humidity, or an exposed substrate, and holding it at the time of exposure, is contained in the measuring object.
[atmospheric pressure / aforementioned]

[0013] Furthermore, an unusual operation prevention means is equipped with a malfunction detection means to detect abnormalities based on the measurement result by the measurement means. This malfunction detection means judges that either of the measurement means is unusual, when the difference of the measured value by two measurement meanses to measure about the measuring object of the same kind exceeds the predetermined range. Furthermore, when the difference of this measurement result by these measurement means and the last measurement result before a predetermined period is over the predetermined range, it is judged that those measurement meanses are unusual. An unusual operation prevention means performs the output or display of a warning to that effect or an error, when a malfunction detection means detects abnormalities.
[0014] Or a malfunction detection means detects the aforementioned abnormalities based on the measurement result about the measuring object of the same kind in other aligners of the same kind on the computer network to which the measurement result about the measuring object by the measurement means and equipment belong. These aligners of the same kind are installed in the same clean room. a malfunction detection means The measurement result by the measurement means in equipment, and the measuring object of the same kind in other aligners of the same kind, Or when the measurement result about the measuring object of the same kind in the environmental control equipment which controls the environment of the aforementioned clean room further shows an unusual change similarly, they are the abnormalities besides equipment. When only the measurement result by the measurement means in equipment shows an unusual change, it is judged that they are the abnormalities in the interior of equipment. It judges that its portion in the equipment related to those measurement meanses is unusual when judging that it is unusual and the measurement result by two or more measurement meanses about the different measuring object relevant to mutual [in equipment] shows an unusual change similarly in the interior of equipment, and the measurement means of a malfunction-detection means is unusual when change only with the unusual measurement result by one measurement means is shown.
[0015] In the desirable operation form in the aligner system of this invention, management equipment has a means to ask for **** of the measurement value between each projection aligner based on the measurement value of each registered aligner. Moreover, from each aligner, management equipment transmits the newest thing of the measurement values registered by the registration means according to this to the aligner, when there is an inquiry of the newest measurement value about the candidate for measurement. Based on the information on the measurement time which is made to accompany a measurement value and has been registered, the newest measurement value is extracted in that case. And the measurement value in consideration of **** between each aligner obtained from the registered measurement value is transmitted. Moreover, in the desirable operation form in another aligner system of this invention, when there is an inquiry of the measurement result about the measuring object from each aligner, as opposed to the aligner, whether a measurement result is transmitted and it transmits by which method of these can always set up management equipment to each aligner.
[0016]
[Example] [Example 1] drawing 1 is the important section schematic diagram of the projection aligner concerning the 1st example of this invention. The reticle on which, as for 1, the circuit pattern was drawn in this drawing, the reticle chuck to which 2 carries out adsorption maintenance of the reticle 1, The reticle driving gear which attached 3 in the reticle chuck 2, the reticle stage to which 4 supports the reticle driving gear 3, The projection lens system (projection optical system) of a reduced type [5], the field lens of a partial lens system with which 6A and 6B constitute the projection lens system 5 respectively, The lens system which consists of the single ** material from which 7 constitutes a part of projection lens system 5, The lens driving gear which 8 makes move field lens 6A in the optical-axis AX direction of the projection lens system 5, The wafer with which, as for 9, sensitization agents, such as a resist, were applied, the wafer chuck to which 10 carries out adsorption maintenance of the wafer 9, The wafer driving gear which attached 11 in the wafer chuck 10, and 12 are wafer stages movable in the field which supports the wafer driving gear 11 and intersects perpendicularly with the optical axis AX of the projection lens system 5.
[0017] The reticle driving gear 3 and the wafer driving gear 11 consist of a piezoelectric device etc.,

make the variation rate of the reticle chuck 2 carry out in the optical-axis AX direction of the projection lens system 5 with the reticle driving gear 3, respectively, move a reticle 1 in the optical-axis AX direction, make the variation rate of the wafer chuck 10 carry out in the optical-axis AX direction of the projection lens system 5 with the wafer driving gear 11, and move a wafer 9 in the optical-axis AX direction. The lens driving gear 8 moves field lens 6A in the optical-axis AX direction of the projection lens system 5 using pneumatic pressure, a piezoelectric device, etc. As concrete structure of the lens driving gear 8, what is indicated by JP,62-32613,A etc. is applicable.

[0018] The drive of the reticle chuck 2 by the reticle driving gear 3 is performed based on the signal from the reticle drive control system 13, and the position of the optical-axis AX direction of a reticle 1 is detected by the reticle position transducer 15 at this time. Moreover, the drive of field lens 6A by the lens driving gear 8 is similarly performed based on the signal from the lens drive control system 16, and the position of the optical-axis AX direction of field lens 6A is detected by the lens position transducer 17 at this time. The reticle position transducer 15 and the lens position transducer 17 can consist of various kinds of position transducers, such as an optical encoder.

[0019] The drive of the wafer chuck 10 by the wafer driving gear 11 is performed based on the signal from the wafer drive control system 14, and the position of the optical-axis AX direction of a wafer 9 (front face) is detected by the focal detector 18 at this time. The focal detector 18 has been used from the former by this kind of projection aligner, for example, consists of an air sensor and an optical sensor. Each signal from the reticle position transducer 15, the lens position transducer 17, and the focal position transducer 18 is inputted into a microprocessor 23.

[0020] In order to form a humidity sensor 21 in the atmospheric pressure sensors (atmospheric pressure measurement means) 19A and 19B and temperature sensor 20 row in order to detect change of the atmospheric pressure around the projection lens system 5, atmospheric temperature, and temperature, and to detect the temperature change by the optical absorption of the projection lens system 5, the lens temperature sensor 22 is formed, and the signal from these various sensors 19A, 19B, 20-22 is also inputted into a microprocessor 23. The reticle drive control system 13, the lens drive control system 16, and the wafer drive control system 14 are controlled by the microprocessor 23. Each elements 13-17 constitute some driving means among more than.

[0021] 24 is an illumination system which illuminates the circuit pattern of a reticle 1 with a uniform illuminance. The illumination system 24 possesses the KrF excimer laser which emits a laser beam with an oscillation wavelength of lambda= 248.4nm as the light source for exposure. The laser beam from an illumination system 24 will be turned on a wafer 9 through a reticle 1 and the projection lens system 5, and reduction projection of the circuit pattern image of a reticle 1 will be carried out on a wafer 9.

[0022] An illumination system 24 is equipped with the laser light source 27 which emits the flux of light by which oscillation wavelength was controlled by the wavelength-selection element drive control system 32 mentioned later, and according to the flux of light from a laser light source 27, through a condensing lens 25, it is made to reflect by the mirror 26 and it illuminates the 1st page top of a reticle uniformly. A laser light source 27 has a laser cavity 28 and the wavelength-selection element 29. The wavelength-selection element driving gear with which 30 drives the wavelength-selection element 29, the wavelength-selection element angle detector with which 31 detects the angle of the wavelength-selection element 29, and 32 are wavelength-selection element drive control systems which control the drive of the wavelength-selection element 29, and each of these elements constitute an element of a wavelength adjustable means.

[0023] The amount of change from the reference value with which the formula for being based on the atmospheric pressure measurement value of an average of two sets of the atmospheric pressure sensors 19A and 19B in the memory 40, and calculating the relative-index-of-refraction variation of the air between the lens systems of the projection lens system 5 is programmed, and atmospheric pressure determined the microprocessor 23 beforehand in each formula serves as a variable. And the image performance of a projection optical system is always made to be kept good by measuring atmospheric pressure, whenever the wafer which should be processed is carried in to a projection aligner, since it corresponds to atmospheric pressure change, changing projection exposure wavelength based on this

measurement result, and being made to perform projection exposure to atmospheric pressure change.
[0024] The atmospheric pressure value measured by two sets of the atmospheric pressure sensors 19A and 19B is recorded on memory 40. Moreover, the setting information on the threshold A for judging whether it is unusual based on the value acquired from these atmospheric pressure sensors, The setting information on the threshold B for judging whether it is unusual based on the old and new atmospheric pressure value which set arbitrary time intervals and was measured by these atmospheric pressure sensors, and **** of the atmospheric pressure sensors 19A and 19B are registered. A microprocessor 23 detects the abnormalities of atmospheric pressure based on the atmospheric pressure value measured by the information and the atmospheric pressure sensors 19A and 19B of such memory 40. And in the case of abnormalities, it warns with alarm equipment 41.
[0025] Drawing 3 is the block diagram showing the outline of the aligner system equipped with two or more such projection aligners 53. Through the network 51, it connects with centralized-control equipment 52, and each projection aligner 53 has composition which can perform both data transfer. Centralized-control equipment 52 can perform atmospheric pressure measurement to each projection aligner in this time by the remote command which directs atmospheric pressure measurement to each projection aligner 53. And centralized-control equipment 52 receives the atmospheric pressure value measured by each projection aligner 53 in this time from each projection aligner 53, and registers it into the memory 54 in 52 in centralized-control equipment. Moreover, centralized-control equipment side 52 is based on the atmospheric pressure value of each projection aligner 53 in this time registered into memory 54, computes **** of the barometer between each projection aligner 53 beforehand, and registers it into memory 54. When an inquiry of the newest atmospheric pressure value is received from each projection aligner 53, the value which added **** between each aforementioned projection aligner 53 to the newest atmospheric pressure value is transmitted to the projection aligner 53.
[0026] Drawing 2 is a flow chart which shows operation of the equipment of drawing 1 . In this equipment, amendment to atmospheric pressure change is carried out at the time of wafer carrying in and focal amendment etc. Moreover, also in an equipment sheep working state, it takes into consideration, atmospheric pressure measurement is carried out periodically, and it is made to register the result into memory 40.
[0027] First, if a job is started as shown in drawing 2 (Step S101), while performing wafer carrying in and focal amendment in Steps S102-S104, two sets of Barometers 19A and 19B will be used at the time of wafer carrying in and focal amendment, and atmospheric pressure measurement will be performed at it. However, two sets of these **** are measured in advance, and they were stored in memory 40 as offset, and are managed.
[0028] Next, in Step S105, the atmospheric pressure value measured with Barometers 19A and 19B is compared, and it judges whether it is more than the threshold A by which the difference of both measurement value was set as memory 40. Since one of barometers is judged to be in an unusual state when it judges with the difference of a measurement value being more than the threshold A, it progresses to Step S110. When it judges with the difference of a measurement value not being more than the threshold A, it progresses to Step S106.
[0029] At Step S106, the last atmospheric pressure value memorized by memory 40 is read, and it judges whether it is more than the threshold B by which the difference of the last atmospheric pressure value and this atmospheric pressure value measured at Step S104 is set as equipment. The last atmospheric pressure value is the newest value of the values measured at intervals of the fixed time interval, for example, 10 minutes, at the time of wafer carrying in and focal amendment. And since the both sides of Barometers 19A and 19B are judged to be in an unusual state when it judges with the difference of the atmospheric pressure value of last time and this time being more than the threshold B, it progresses to Step S110. Since it is judged that the atmospheric pressure value measured this time is normal when it judges with the difference of the atmospheric pressure value of last time and this time not being more than the threshold B, it progresses to Step S107.
[0030] At Step S107, this atmospheric pressure value, the device number, and time are transmitted to centralized-control equipment 52 through a network 51. Centralized-control equipment 52 will be

registered into memory 54 if this is received. Centralized-control equipment 52 is carried out in this way, always receives the newest atmospheric pressure value from each projection aligner 53, and is recording it on memory 54.

[0031] Next, in Step S108, based on the atmospheric pressure value measured at Step S104, amendment of a focal position and a projection scale factor is performed, and a circuit pattern is exposed in Step S109, and a job is ended.

[0032] On the other hand, alarm is outputted when it progresses to Step S110. Next, in Step S111, the newest atmospheric pressure value registered into memory 54 is asked to centralized-control equipment 52, and the value which added **** between each projection aligner 53 to the newest atmospheric pressure value is received from centralized-control equipment 52. Next, in Step S112, with the received atmospheric pressure value, the atmospheric pressure value measured at Step S104 is replaced, and it progresses to Step S108. Therefore, at Steps S108 and S109, based on the replaced atmospheric pressure value, amendment of a focal position and a projection scale factor will be performed, and a circuit pattern will be exposed.

[0033] The reason for having adopted such processing is as follows. Atmospheric pressure is not sharply changed in the short term, although a big change in the long run is seen. Moreover, it can be guessed that atmospheric pressure change produced in a clean room is what produces the almost same atmospheric pressure change also in each projection aligner in the clean room. However, when a noise occurs according to some troubles, such as a poor contact of a cable connector, in a projection aligner, a barometer may gather the noise, and may malfunction and 1.5hpa(s) may also change for a short time. Such change can be clearly regarded as a malfunction.

[0034] Then, the amount of change of the atmospheric pressure in the short period of time measured and obtained is checked, and when it becomes more than fixed [the amount of change is], it is made to regard it as the abnormalities of Barometers 19A and 19B in this example. That is, in case abnormalities are judged, or change of the measurement value of atmospheric pressure will not be based on failure of the meter itself by using the difference of the measurement value by two sets of the barometers 19A and 19B in a projection aligner, and the difference of the measurement value of this time and last time, it is made to judge whether it is what is depended on an external factor (Steps S105 and S106). This is bearing a role of one information which shortens time to a failure return while it is useful to a subsequent cause investigation.

[0035] However, stopping equipment immediately, when barometer 19A and/or 19B are judged to be unusual, and stopping production is connected with reducing productivity. Consequently, a production schedule may be unable to be attained. Then, in this example, further, in order to make a halt of equipment avoid, processing continuation is enabled between 1 commuter's tickets by substituting for the atmospheric pressure value of other aligners (Steps S111 and S112), and performing focal position amendment and projection scale-factor amendment temporarily.

[0036] Although it is made to transmit the value which centralized-control equipment 52 registered the atmospheric pressure value from each projection aligner 53, and added **** between each projection aligner 53 to the newest atmospheric pressure value to the semiconductor aligner 53 with the inquiry in the 1st example of the [example 2] above The atmospheric pressure sensor 55 is formed in the centralized-control equipment 52 of drawing 3 , and it is made to instead transmit the same atmospheric pressure value to all the projection aligners 53 by this example. And the atmospheric pressure value measured by the atmospheric pressure sensor 55 connected to centralized-control equipment 52 was always transmitted to each projection aligner 53, or it has the means which can choose whether the atmospheric pressure value of each projection aligner 53 transmits the newest atmospheric pressure value managed with centralized-control equipment 52 only at the time of abnormalities, and an atmospheric pressure value is transmitted to each projection aligner 53 according to the setup.

[0037] [Example 3] drawing 4 is the perspective diagram showing the appearance of the semiconductor aligner concerning the 3rd example of this invention. As shown in this drawing, this semiconductor aligner is arranged to the ** tone chamber 101 which performs environmental temperature control of the main part of equipment, and its interior. In the EWS main part 106 and row which have CPU which

controls the main part of equipment In the display unit 102 for EWS and the main part of equipment which display the predetermined information in equipment It has the console section containing the control panel 103 for performing a predetermined input to the monitor TV 105 which displays the image information obtained through an image pck-up means, and equipment, and the keyboard 104 grade for EWS. For an emergency stop switch and 109, as for a LAN telecommunication cable and 111, 110, such as various switches and a mouse, is [107 / an ON-OFF switch and 108 / the jet pipe of generation of heat from a console function and 112] the exhausts of a chamber among drawing. A semiconductor aligner main part is installed in the interior of a chamber 101.

[0038] The display 102 for EWS is a thing thin shape flat type [, such as EL, plasma, and liquid crystal,], is dedicated to chamber 101 front face, and is connected with the EWS main part 106 by the LAN cable 110. A control panel 103, a keyboard 104, and monitor TV105 grade are also installed in chamber 101 front face, and enable it to have performed the same console operation as usual from chamber 101 front face.

[0039] Drawing 5 is drawing showing the internal structure of the equipment of drawing 4 . The stepper as a semiconductor aligner is shown in this drawing. Among drawing, a reticle and 203 are wafers, and 202 can imprint the pattern on a reticle 202 to the photosensitive layer on a wafer 203 with the projection lens 206, when the flux of light which came out of light equipment 204 illuminates a reticle 202 through the lighting optical system 205. The reticle 202 is supported by the reticle stage 207 for holding a reticle 202 and moving. A wafer 203 is exposed after vacuum adsorption has been carried out by the wafer chuck 291. The wafer chuck 291 is movable to each shaft orientations with the wafer stage 209. The reticle optical system 281 for detecting the amount of position gaps of a reticle is arranged at the reticle 202 bottom. The projection lens 206 is adjoined above the wafer stage 209, and the off-axis microscope 282 is arranged. It is a main role that the off-axis microscope 282 performs relative-position detection with an internal reference mark and the alignment mark on a wafer 203. Moreover, these stepper main part is adjoined, the reticle library 220 and the wafer carrier elevator 230 which are a peripheral device are arranged, and a required reticle and a required wafer are conveyed by the reticle transport device 221 and the wafer transport device 231 at a stepper main part.

[0040] The chamber 101 is constituted by the filter box 213 which filters the air-conditioning cabin 210 and minute foreign matter which mainly perform temperature control of air, and forms the uniform flow of pure air, and the booth 214 which intercepts equipment environment with the exterior in a row. Within a chamber 101, the air by which temperature control was carried out at the condensator 215 and the reheat heater 216 in the air-conditioning cabin 210 is supplied in a booth 214 through an air filter g by the blower 217. The air supplied to this booth 214 is again incorporated from the return mouth ra in the air-conditioning cabin 210, and circulates through the inside of a chamber 101. Usually, strictly, this chamber 101 has introduced the air outside the booth 214 of about ten percent of the amount of recirculating airs through a blower from the open air inlet oa in which it was prepared in the air-conditioning cabin 210, in order to always maintain the inside of not the perfect circulatory system but the booth 214 at a positive pressure. Thus, it makes it possible for a chamber 101 to keep constant the environmental temperature on which this equipment is put, and to keep air pure. Moreover, in preparation for cooling of a ultrahigh pressure mercury lamp, or poisonous gas generating at the time of laser abnormalities, an inlet port sa and an exhaust port ea are formed in light equipment 204, and the forcible exhaust air of a part of air in a booth 214 is carried out via light equipment 204 at the plant through the ventilating fan of the exclusive use with which the air-conditioning cabin 210 was equipped. Moreover, it connected with the open air inlet oa and the return mouth ra of the air-conditioning cabin 210, respectively, and they are equipped with the chemisorption filter cf for removing the chemical in air.

[0041] Drawing 6 is the block diagram showing the electrical circuit composition of the equipment of drawing 4 . In this drawing, 301 is the main part CPU which manages control of the whole equipment, and consists of central arithmetic units, such as a microcomputer or a minicomputer. 302 -- for a reticle-stage driving gear and 305, as for a shutter driving gear and 307, illumination systems, such as light equipment, and 306 are [a wafer stage driving gear and 303 / alignment detection systems, such as an

off-axis microscope and 304 / a focal detection system and 308] Z driving gears, and these are controlled by the main part CPU 301 For 309, as for an atmospheric pressure sensor and 311, conveyance systems, such as a reticle transport device and a wafer transport device, and 310 are [a temperature sensor and 312] humidity sensors.

[0042] 300 is a console unit which has auxiliary memory 314, a display 317, a keyboard 316, and external storage 315, and is for giving various kinds of commands and parameters about operation of this aligner to a main part CPU 313. That is, it is for delivering and receiving information among operators. Auxiliary memory 314 is a hard disk, the database is built inside and various parameters, the management data of those, etc. are recorded. As external storage 315, things, such as FDD (floppy disk drive) and MOD (Magnetic-Optical disk drive), can be considered. 318 may use the protocol which has spread generally [NetWare etc.], although it is a network interface and standard network protocols, such as TCP/IP, are used in many cases as a protocol in the case of communicating. A program and data read the data stored in media from external storage 315, and are saved at auxiliary memory 314.

[0043] This semiconductor aligner must keep constant environmental values, such as atmospheric pressure in equipment, temperature, and humidity, in order to carry out highly precise semiconductor exposure. However, these environmental values tend to receive the environmental influence besides aligners, such as change of change of the atmospheric pressure by the weather, the room temperature in a clean room, and humidity. Therefore, it was conventionally difficult to judge immediately whether it is what depends whether it is failure of a control apparatus and the measurement sensor of atmospheric pressure sensor 310 grade about the environment of the air-conditioning machine in an aligner etc. though these environmental values in an aligner show outlying observation on the environmental variation besides an aligner.

[0044] Then, in this example, as shown in drawing 7 , two or more semiconductor aligners 404 of the same model installed in the clean room 401 are connected with the network communication network 402 through a network interface 318, and environmental values, such as mutual atmospheric pressure, temperature, and humidity, are mutually checked between each aligner 404. And when the environmental value of all the aligners 404 changes similarly It tells that the environmental value change judged it as the thing resulting from the environmental variation besides an aligner 404, and abnormalities arose to the operator at the environment besides an aligner 404. It tells that judged only the specific aligner 404 that abnormalities occurred in the aligner 404, and abnormalities produced it within the aligner 404 to the operator when the environmental value was changing. Moreover, when the value in which two or more environmental values, such as atmospheric pressure in a certain aligner 404, temperature, and humidity, differ from other aligners 404 is shown, it judges that abnormalities occurred in the function of the chamber of the aligner 404, and an operator is told about abnormalities having arisen within the aligner 404. In addition, the semiconductor aligner 404 is explained using drawing 4 - 6.

[0045] Drawing 8 is a flow chart which shows operation of the aligner 404 for performing such processing. If processing is started as shown in this drawing, in Step 501, it will judge whether the environmental value influenced of environmental variations, such as atmospheric pressure, temperature, and humidity, for every fixed time is acquired, and the environmental value of all aligners is changing from the aligner 404 of all the same models on a network similarly in Step 502. When it judges with the environmental value of all the aligners 404 changing similarly, possibility that progress to Step 510, and the environment besides an aligner is changing, or abnormalities have arisen in the environmental control facility besides an aligner tells an operator about a high thing, and ends processing. For example, it judges that change of the weather has taken place when the atmospheric pressure of all the aligners 404 is changing at same rate, and when temperature is changing at same rate, it is judged that abnormalities may have occurred in the environmental control of a clean room 401.

[0046] In Step 502, when it judges with not all the environmental value of aligners changing similarly, it progresses to Step 503 and judges whether there is any different environmental value from other aligners. When it judges with it returning to Step 501 when it judges with there being no environmental value which is different from other aligners here, and there being a different environmental value, it

progresses to Step 504. At Step 504, it judges whether it differs from other aligners about other environmental values. If other environmental values differ, in Step 505, it will judge that abnormalities occurred to the environmental control equipment in an aligner, and will progress to Step 507. Otherwise, in Step 506, it judges that they are the abnormalities of the sensor which measures the environmental value, and progresses to Step 507.

[0047] For example, the chamber equipment which controls air-conditioning in Step 506 when it judges with the temperature in an aligner being outlying observation in Step 503 and judges with humidity being outlying observation in Step 504 is unusual, and when it judges with humidity being normal in Step 504, in Step 506, a temperature sensor judges that it is unusual.

[0048] At Step 507, if it is not less than constant value, after it judges whether a difference with the environmental value in other aligners is less than constant value, it displays a warning message by step 508 HE **** with constant value [less than], and displaying an error message in Step 509, processing is ended.

[0049] Drawing 9 is a flow chart which shows the processing about a vacuum ** value in which a wafer is adsorbed. If processing is started as shown in this drawing, in Step 601, it will judge whether vacuum ** is acquired for every fixed time, and vacuum ** of all aligners is changing from the aligner of all the same models on a network similarly in Step 602. If it is changing similarly, it will progress to Step 610, an operator will be told about possibility that abnormalities have arisen to the compressor which controls vacuum ** in a clean room being high, and processing will be ended. If it is not changing similarly, it will progress to Step 603 and will judge whether the value in which vacuum ** in an aligner differs from other aligners was shown. When it returns to Step 601 when a different value is not shown, and a different value is shown, in Step 604, it judges whether vacuum ****** differs from other aligners. If it differs, it judges that abnormalities occurred in the vacuum mechanism in an aligner in Step 605, and progresses to Step 607, and if it does not differ, after judging that they are the abnormalities of a vacuum ****** sensor in Step 606, it will progress to Step 607.

[0050] At Step 607, if it is not below constant value, after the difference of vacuum ** with other aligners judges whether it is below constant value, with constant value [below] it displays a warning message in Step 608, and it ends processing, and expressing an error message as Step 609, processing is ended.

[0051] The example of the device manufacture method of having used the <example of the device manufacture method> next the aligner which gave [above-mentioned] explanation, or the aligner system is explained. Drawing 10 shows the flow of manufacture of minute devices (semiconductor chips, such as IC and LSI, a liquid crystal panel, CCD, the thin film magnetic head, micro machine, etc.). The pattern design of a device is performed at Step 1 (circuit design). The mask in which the designed pattern was formed is manufactured at Step 2 (mask manufacture). On the other hand, at Step 3 (wafer manufacture), a wafer is manufactured using material, such as silicon and glass. Step 4 (wafer process) is called last process, and forms an actual circuit on a wafer with lithography technology using the mask and wafer which carried out [above-mentioned] preparation. The following step 5 (assembly) is called back process, is a process semiconductor-chip-ized using the wafer produced by Step 4, and includes processes, such as an assembly process (dicing, bonding) and a packaging process (chip enclosure). At Step 6 (inspection), the check test of the semiconductor device produced at Step 5 of operation, an endurance test, etc. are inspected. Through such a process, a semiconductor device is completed and this is shipped (Step 7).

[0052] Drawing 11 shows the detailed flow of the above-mentioned wafer process (Step 4). The front face of a wafer is oxidized at Step 11 (oxidization). An insulator layer is formed in a wafer front face at Step 12 (CVD). At Step 13 (electrode formation), an electrode is formed by vacuum evaporationo on a wafer. Ion is driven into a wafer at Step 14 (ion implantation). A resist is applied to a wafer at Step 15 (resist processing). At Step 16 (exposure), by the aligner or the exposure method which gave [above-mentioned] explanation, the circuit pattern of a mask is arranged in two or more shot fields of a wafer, and printing exposure is carried out. The exposed wafer is developed at Step 17 (development). At Step 18 (etching), portions other than the developed resist image are shaved off. The resist which etching

could be managed with Step 19 (resist exfoliation), and became unnecessary is removed. By carrying out by repeating these steps, a circuit pattern is formed on a wafer multiplex. If the process of this example is used, the large-sized device for which manufacture was difficult can be conventionally manufactured to a low cost.

[0053]

[Effect of the Invention] As explained above, since operation in the unusual state was prevented also with reference to the measurement result in other equipments according to this invention, when a measurement means shows unusual measured value, the cause can be judged exactly and continuation of operation under an unusual state can be prevented exactly. For example, whether when the measurement means of atmospheric pressure shows an unusual value, outlying observation is failure of measurement sensors, such as an environmental control apparatus and an atmospheric pressure sensor, of the air-conditioning machine in an aligner etc. Processing can be continued without stopping equipment by using as an alternative the newest atmospheric pressure value acquired from management equipment etc., while judging appropriately and immediately that it is what is depended on the environmental variation besides an aligner etc. and preventing amendment [made / the mistake / in according to an unusual value].

[0054] Moreover, device manufacture can be continued, without supplying the registered newest measurement value to the aligner as the alternative value, and stopping operation of the aligner with management equipment, when the measurement value about the predetermined candidate for measurement in each aligner is unusual, since it enabled it to supply the newest measurement result to each aligner.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention measures about the predetermined measuring object in equipment, and equipment is related with the device manufacture method that the aligner system and these which have the aligner which prevented operating under an unusual state, and this can be used, based on this measurement result.

[Translation done.]

JAPANESE [JP,2000-331921,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

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PRIOR ART

[Description of the Prior Art] In recent years, according to the demand to high integration of semiconductor devices, such as IC and LSI, the high integration is gathering acceleration increasingly. The circuit pattern image of a mask (reticle) is formed on a sensitization substrate by the projection optical system, and various improvement for improvement in resolution is made also in the reduced type projection aligner (stepper) which exposes a sensitization substrate by the step-and-repeat method.
[0003] the optical-character ability (an image formation scale factor and image formation performance) of the projection optical system which carries out reduction projection of the pattern on a reticle side on a wafer side is variously boiled by the environmental variation, for example, an allobar, and changes In the projection aligner as which the latest high resolution is requested, the error of the optical-character ability generated by change of atmospheric pressure serves as a big trouble, and it is important to amend and project the error of this optical-character ability.
[0004] In order to solve this, it sets to JP,06-342755,A. The table on which a semiconductor wafer is laid, lighting optical system, and the reticle which has a desired imprint pattern, The projection optical system which consists of a lens group containing two or more lenses, and projects the aforementioned imprint pattern on one principal plane of the aforementioned semiconductor wafer, The scale-factor adjustment mechanism in which the projection scale factor of the aforementioned imprint pattern to the aforementioned semiconductor wafer is adjusted by moving the aforementioned lens by the side of the aforementioned reticle or the aforementioned reticle in the aforementioned projection optical system, It is the reduction projection exposure method using the reduction projection aligner which has the focal justification mechanism in which the focal position to the aforementioned semiconductor wafer of the aforementioned projection optical system is adjusted. According to the 1st phase of detecting change of atmospheric pressure or the environmental atmospheric pressure of the aforementioned reduction projection aligner, and the focal justification mechanism in which the distance of the aforementioned projection optical system and the aforementioned table is relatively changed according to change of the aforementioned atmospheric pressure or environmental atmospheric pressure The 2nd phase of performing operation of adjusting the focal position to the aforementioned semiconductor wafer of the aforementioned projection optical system independently of adjustment operation of the aforementioned projection scale factor by the aforementioned scale-factor adjustment mechanism, The projection exposure method characterized by the bird clapper from the 3rd phase which imprints the aforementioned imprint pattern of the aforementioned reticle to the aforementioned semiconductor wafer is proposed.
[0005] Moreover, it sets to JP,08-305034,A. In the equipment which projects the pattern of the 1st body on the 2nd body by the projection optical system An atmospheric pressure detection means to detect change of the atmospheric pressure relevant to the aforementioned projection optical system, and a wavelength change means to change the wavelength of the light used for projection of the pattern of the 1st body of the above, change of the relative index of refraction of the ** material of the aforementioned projection optical system undergo the output of the aforementioned atmospheric pressure detection means, and according to change of the aforementioned atmospheric pressure -- an amendment -- the

projection exposure method characterized by having a wavelength change means to change the wavelength of the light used for projection of the pattern of the 1st body of the above like is proposed By these methods, it can amend good by using the atmospheric pressure measurement means and the adjustment mechanism which an everyday atmospheric pressure change and change of the optical-character ability corresponding to the atmospheric pressure of an installation were set up appropriately, in case the pattern on a reticle side is projected on a wafer side by the projection optical system, and the manufacture method of a device using the projection aligner and it from which high optical-character ability is obtained easily can be attained.
[0006]

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, since operation in the unusual state was prevented also with reference to the measurement result in other equipments according to this invention, when a measurement means shows unusual measured value, the cause can be judged exactly and continuation of operation under an unusual state can be prevented exactly. When the measurement means of atmospheric pressure shows an unusual value for example, while judging appropriately and immediately that it is what depends whether outlying observation is failure of measurement sensors, such as an environmental control apparatus and an atmospheric pressure sensor, of the air-conditioning machine in an aligner etc. on the environmental variation besides an aligner etc. and preventing amendment [made / the mistake / in according to an unusual value]. Processing can be continued without stopping equipment by using as an alternative the newest atmospheric pressure value acquired from management equipment etc.
[0054] Moreover, device manufacture can be continued, without supplying the registered newest measurement value to the aligner as the alternative value, and stopping operation of the aligner with management equipment, when the measurement value about the predetermined candidate for measurement in each aligner is unusual, since it enabled it to supply the newest measurement result to each aligner.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, by factors, such as an electric noise, an atmospheric pressure measurement means to offer the information which serves as a basis when deciding the amount of amendments malfunctions, and sometimes measures outlying observation rarely. It is not noticed, but if a projection aligner amends a focal position and a projection scale factor using a focus control mechanism or a scale-factor adjustment mechanism based on the outlying observation which the atmospheric pressure measurement means measured, the problem that the pattern imprinted to the semiconductor wafer will be poor will occur. Moreover, since a semiconductor aligner is very complicated and precise equipment, when exposing a semiconductor, it needs to maintain environment, such as temperature in equipment, and humidity, within fixed limits besides atmospheric pressure. Then, although it has judged that a certain abnormalities occurred to equipment when those environmental values become uniformly out of range conventionally, environmental values, such as atmospheric pressure and temperature, are not necessarily failures of the equipment concerned, though the weather, clean room environment, etc. may receive the environmental influence besides equipment and become outlying observation. In this case, it is difficult to make being based on change of the environment besides equipment judgment whether to be unusual or not in the present condition.
[0007] In order it prevents operation of the equipment in an unusual state to the 1st in an aligner, an aligner system, and the device manufacture method in view of the trouble of the above-mentioned conventional technology, the purpose of this invention is to distinguish the case where it is what the outlying observation depends on failure of a measurement means, and enable it to distinguish the case where it is failure of other portions of equipment further, when measurement meanses, such as atmospheric pressure, showed outlying observation. It is in enabling it to continue device manufacture, without 2nd stopping operation of equipment, even when outlying observation is what is depended on failure of a measurement means.

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MEANS

[Means for Solving the Problem] In order to attain this purpose the aligner of this invention In the aligner equipped with a measurement means to measure about the predetermined measuring object in equipment, and an unusual operation prevention means to prevent that equipment operates under an unusual state based on this measurement result The aforementioned unusual operation prevention means is characterized by being what prevents operation in the unusual state of the aforementioned equipment also with reference to the measurement result in other equipments about the aforementioned measuring object. In this composition, when a measurement means shows unusual measured value, the cause is judged also with reference to the measurement result in other equipments, and continuation of operation under an unusual state is prevented based on this result. Therefore, that to which outlying observation originates in equipment itself, the thing to depend on the cause besides equipment is judged appropriately, and when outlying observation is caused unusually [the measurement means of equipment], correspondence suitable [of continuing operation as an alternative value using the measurement result in other equipments] is made.
[0009] Moreover, in the aligner system equipped with the management equipment which manages the aligner and this from which the aligner system of this invention constitutes the computer network, the aforementioned management equipment is characterized by to provide a directions means direct the measurement about the predetermined candidate for measurement to each aligner, and a registration means receive and register the measurement value in each aligner measured according to this. In this composition, management equipment acquires from each aligner and the registered measurement value is used with a various gestalt. For example, when the measurement value about the predetermined candidate for measurement in a certain aligner is unusual, the registered newest measurement value is supplied to the aligner as the alternative value. Or based on the registered measured value, it is judged exactly whether it is that to which the unusual measurement value about the predetermined candidate for measurement in a certain aligner originates in the equipment.
[0010] Moreover, another aligner system of this invention is characterized by the aforementioned management equipment being what is equipped with a measurement means to measure about the predetermined measuring object, and transmits the measurement result by this measurement means to each aligner through the aforementioned network in the aligner system equipped with the management equipment which manages the aligner and this which constitute the computer network. In this composition, when the measurement value about the predetermined candidate for measurement in a certain aligner is unusual, the newest measurement value measured in management equipment as the alternative value is supplied to the aligner, and, thereby, the aligner continues operation.
[0011] Moreover, the device manufacture method of this invention measures about the predetermined measuring object in an aligner, and it is characterized in the device manufacture method of manufacturing a device, by exposing by the aforementioned aligner by to prevent operation in the unusual state of the aforementioned aligner also with reference to the measurement result in other aligner or other equipments about the aforementioned measuring object, preventing that the aforementioned aligner operates under an unusual state based on this measurement result. Also in this

composition, like the aligner of this invention, that to which outlying observation originates in equipment itself, the thing to depend on the cause besides equipment is judged appropriately, and when outlying observation is caused unusually [the measurement means of equipment], correspondence suitable [of continuing operation as an alternative value using the measurement result in other equipments] is made.

[0012]

[Embodiments of the Invention] In the desirable operation gestalt in the aligner of this invention, both equipment besides the above is management equipment which manages the aligner contained in the aligner of the others which constitute the computer network, or its network, and refer to the newest measurement result about the aforementioned measuring object which management equipment acquires from the aligner contained in the aforementioned network by the own measurement means, and is held for an unusual operation prevention means. Atmospheric pressure is contained in the measuring object, and an unusual operation prevention means receives supply of the measurement result about the newest atmospheric pressure from management equipment, and performs amendment of the projection scale factor for exposure, and a focal position based on it. **** between the aligners in which the measurement result which receives supply in that case is included in a network is taken into consideration. A measurement means measures atmospheric pressure, the unusual operation prevention means has the unusual measurement result of the atmospheric pressure, and when it is what the abnormality depends on a measurement means, it receives supply of the aforementioned measurement result as an alternative value of the unusual measurement result. Moreover, it has a transmitting means to transmit the measurement result about the measuring object to management equipment, and this transmitting means transmits on the occasion of transmission of a measurement result including the number and measurement time of equipment. Vacuum ** for adsorbing others, temperature, humidity, or an exposed substrate, and holding it at the time of exposure, is contained in the measuring object. [atmospheric pressure / aforementioned]

[0013] Furthermore, an unusual operation prevention means is equipped with a malfunction detection means to detect abnormalities based on the measurement result by the measurement means. This malfunction detection means judges that either of the measurement means is unusual, when the difference of the measured value by two measurement meanses to measure about the measuring object of the same kind exceeds the predetermined range. Furthermore, when the difference of this measurement result by these measurement means and the last measurement result before a predetermined period is over the predetermined range, it is judged that those measurement meanses are unusual. An unusual operation prevention means performs the output or display of a warning to that effect or an error, when a malfunction detection means detects abnormalities.

[0014] Or a malfunction detection means detects the aforementioned abnormalities based on the measurement result about the measuring object of the same kind in other aligners of the same kind on the computer network to which the measurement result about the measuring object by the measurement means and equipment belong. These aligners of the same kind are installed in the same clean room. a malfunction detection means The measurement result by the measurement means in equipment, and the measuring object of the same kind in other aligners of the same kind, Or when the measurement result about the measuring object of the same kind in the environmental control equipment which controls the environment of the aforementioned clean room further shows an unusual change similarly, they are the abnormalities besides equipment. When only the measurement result by the measurement means in equipment shows an unusual change, it is judged that they are the abnormalities in the interior of equipment. It judges that its portion in the equipment related to those measurement meanses is unusual when judging that it is unusual and the measurement result by two or more measurement meanses about the different measuring object relevant to mutual [in equipment] shows an unusual change similarly in the interior of equipment, and the measurement means of a malfunction-detection means is unusual when change only with the unusual measurement result by one measurement means is shown.

[0015] In the desirable operation gestalt in the aligner system of this invention, management equipment has a means to ask for **** of the measurement value between each projection aligner based on the

measurement value of each registered aligner. Moreover, from each aligner, management equipment transmits the newest thing of the measurement values registered by the registration means according to this to the aligner, when there is an inquiry of the newest measurement value about the candidate for measurement. Based on the information on the measurement time which is made to accompany a measurement value and has been registered, the newest measurement value is extracted in that case. And the measurement value in consideration of **** between each aligner obtained from the registered measurement value is transmitted. Moreover, in the desirable operation gestalt in another aligner system of this invention, when there is an inquiry of the measurement result about the measuring object from each aligner, as opposed to the aligner, whether a measurement result is transmitted and it transmits by which method of these can always set up management equipment to each aligner.

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EXAMPLE

[Example] [Example 1] drawing 1 is the important section schematic diagram of the projection aligner concerning the 1st example of this invention. The reticle on which, as for 1, the circuit pattern was drawn in this drawing, the reticle chuck to which 2 carries out adsorption maintenance of the reticle 1, The reticle driving gear which attached 3 in the reticle chuck 2, the reticle stage to which 4 supports the reticle driving gear 3, The projection lens system (projection optical system) of a reduced type [5], the field lens of a partial lens system with which 6A and 6B constitute the projection lens system 5 respectively, The lens system which consists of the single ** material from which 7 constitutes a part of projection lens system 5, The lens driving gear which 8 makes move field lens 6A in the optical-axis AX direction of the projection lens system 5, The wafer with which, as for 9, sensitization agents, such as a resist, were applied, the wafer chuck to which 10 carries out adsorption maintenance of the wafer 9, The wafer driving gear which attached 11 in the wafer chuck 10, and 12 are wafer stages movable in the field which supports the wafer driving gear 11 and intersects perpendicularly with the optical axis AX of the projection lens system 5.
[0017] The reticle driving gear 3 and the wafer driving gear 11 consist of a piezoelectric device etc., make the variation rate of the reticle chuck 2 carry out in the optical-axis AX direction of the projection lens system 5 with the reticle driving gear 3, respectively, move a reticle 1 in the optical-axis AX direction, make the variation rate of the wafer chuck 10 carry out in the optical-axis AX direction of the projection lens system 5 with the wafer driving gear 11, and move a wafer 9 in the optical-axis AX direction. The lens driving gear 8 moves field lens 6A in the optical-axis AX direction of the projection lens system 5 using pneumatic pressure, a piezoelectric device, etc. As concrete structure of the lens driving gear 8, what is indicated by JP,62-32613,A etc. is applicable.
[0018] The drive of the reticle chuck 2 by the reticle driving gear 3 is performed based on the signal from the reticle drive control system 13, and the position of the optical-axis AX direction of a reticle 1 is detected by the reticle position transducer 15 at this time. Moreover, the drive of field lens 6A by the lens driving gear 8 is similarly performed based on the signal from the lens drive control system 16, and the position of the optical-axis AX direction of field lens 6A is detected by the lens position transducer 17 at this time. The reticle position transducer 15 and the lens position transducer 17 can consist of various kinds of position transducers, such as an optical encoder.
[0019] The drive of the wafer chuck 10 by the wafer driving gear 11 is performed based on the signal from the wafer drive control system 14, and the position of the optical-axis AX direction of a wafer 9 (front face) is detected by the focal detector 18 at this time. The focal detector 18 has been used from the former by this kind of projection aligner, for example, consists of an air sensor and an optical sensor. Each signal from the reticle position transducer 15, the lens position transducer 17, and the focal position transducer 18 is inputted into a microprocessor 23.
[0020] In order to form a humidity sensor 21 in the atmospheric pressure sensors (atmospheric pressure measurement means) 19A and 19B and temperature sensor 20 row in order to detect change of the atmospheric pressure around the projection lens system 5, atmospheric temperature, and temperature, and to detect the temperature change by the optical absorption of the projection lens system 5, the lens

temperature sensor 22 is formed, and the signal from these various sensors 19A, 19B, 20-22 is also inputted into a microprocessor 23. The reticle drive control system 13, the lens drive control system 16, and the wafer drive control system 14 are controlled by the microprocessor 23. Each elements 13-17 constitute some driving means among more than.

[0021] 24 is an illumination system which illuminates the circuit pattern of a reticle 1 with a uniform illuminance. The illumination system 24 possesses the KrF excimer laser which emits a laser beam with an oscillation wavelength of lambda= 248.4nm as the light source for exposure. The laser beam from an illumination system 24 will be turned on a wafer 9 through a reticle 1 and the projection lens system 5, and reduction projection of the circuit pattern image of a reticle 1 will be carried out on a wafer 9.

[0022] An illumination system 24 is equipped with the laser light source 27 which emits the flux of light by which oscillation wavelength was controlled by the wavelength-selection element drive control system 32 mentioned later, and according to the flux of light from a laser light source 27, through a condensing lens 25, it is made to reflect by the mirror 26 and it illuminates the 1st page top of a reticle uniformly. A laser light source 27 has a laser cavity 28 and the wavelength-selection element 29. The wavelength-selection element driving gear with which 30 drives the wavelength-selection element 29, the wavelength-selection element angle detector with which 31 detects the angle of the wavelength-selection element 29, and 32 are wavelength-selection element drive control systems which control the drive of the wavelength-selection element 29, and each of these elements constitute an element of a wavelength adjustable means.

[0023] The amount of change from the reference value with which the formula for being based on the atmospheric pressure measurement value of an average of two sets of the atmospheric pressure sensors 19A and 19B in the memory 40, and calculating the relative-index-of-refraction variation of the air between the lens systems of the projection lens system 5 is programmed, and atmospheric pressure determined the microprocessor 23 beforehand in each formula serves as a variable. And the image performance of a projection optical system is always made to be kept good by measuring atmospheric pressure, whenever the wafer which should be processed is carried in to a projection aligner, since it corresponds to atmospheric pressure change, changing projection exposure wavelength based on this measurement result, and being made to perform projection exposure to atmospheric pressure change.

[0024] The atmospheric pressure value measured by two sets of the atmospheric pressure sensors 19A and 19B is recorded on memory 40. Moreover, the setting information on the threshold A for judging whether it is unusual based on the value acquired from these atmospheric pressure sensors, The setting information on the threshold B for judging whether it is unusual based on the old and new atmospheric pressure value which set arbitrary time intervals and was measured by these atmospheric pressure sensors, and **** of the atmospheric pressure sensors 19A and 19B are registered. A microprocessor 23 detects the abnormalities of atmospheric pressure based on the atmospheric pressure value measured by the information and the atmospheric pressure sensors 19A and 19B of such memory 40. And in the case of abnormalities, it warns with alarm equipment 41.

[0025] Drawing 3 is the block diagram showing the outline of the aligner system equipped with two or more such projection aligners 53. Through the network 51, it connects with centralized-control equipment 52, and each projection aligner 53 has composition which can perform both data transfer. Centralized-control equipment 52 can perform atmospheric pressure measurement to each projection aligner in this time by the remote command which directs atmospheric pressure measurement to each projection aligner 53. And centralized-control equipment 52 receives the atmospheric pressure value measured by each projection aligner 53 in this time from each projection aligner 53, and registers it into the memory 54 in 52 in centralized-control equipment. Moreover, centralized-control equipment side 52 is based on the atmospheric pressure value of each projection aligner 53 in this time registered into memory 54, computes **** of the barometer between each projection aligner 53 beforehand, and registers it into memory 54. When an inquiry of the newest atmospheric pressure value is received from each projection aligner 53, the value which added **** between each aforementioned projection aligner 53 to the newest atmospheric pressure value is transmitted to the projection aligner 53.

[0026] Drawing 2 is a flow chart which shows operation of the equipment of drawing 1 . In this

equipment, amendment to atmospheric pressure change is carried out at the time of wafer carrying in and focal amendment etc. Moreover, also in an equipment sheep working state, it takes into consideration, atmospheric pressure measurement is carried out periodically, and it is made to register the result into memory 40.

[0027] First, if a job is started as shown in drawing 2 (Step S101), while performing wafer carrying in and focal amendment in Steps S102-S104, two sets of Barometers 19A and 19B will be used at the time of wafer carrying in and focal amendment, and atmospheric pressure measurement will be performed at it. However, two sets of these **** are measured in advance, and they were stored in memory 40 as offset, and are managed.

[0028] Next, in Step S105, the atmospheric pressure value measured with Barometers 19A and 19B is compared, and it judges whether it is more than the threshold A by which the difference of both measurement value was set as memory 40. Since one of barometers is judged to be in an unusual state when it judges with the difference of a measurement value being more than the threshold A, it progresses to Step S110. When it judges with the difference of a measurement value not being more than the threshold A, it progresses to Step S106.

[0029] At Step S106, the last atmospheric pressure value memorized by memory 40 is read, and it judges whether it is more than the threshold B by which the difference of the last atmospheric pressure value and this atmospheric pressure value measured at Step S104 is set as equipment. The last atmospheric pressure value is the newest value of the values measured at intervals of the fixed time interval, for example, 10 minutes, at the time of wafer carrying in and focal amendment. And since the both sides of Barometers 19A and 19B are judged to be in an unusual state when it judges with the difference of the atmospheric pressure value of last time and this time being more than the threshold B, it progresses to Step S110. Since it is judged that the atmospheric pressure value measured this time is normal when it judges with the difference of the atmospheric pressure value of last time and this time not being more than the threshold B, it progresses to Step S107.

[0030] At Step S107, this atmospheric pressure value, the device number, and time are transmitted to centralized-control equipment 52 through a network 51. Centralized-control equipment 52 will be registered into memory 54 if this is received. Centralized-control equipment 52 is carried out in this way, always receives the newest atmospheric pressure value from each projection aligner 53, and is recording it on memory 54.

[0031] Next, in Step S108, based on the atmospheric pressure value measured at Step S104, amendment of a focal position and a projection scale factor is performed, and a circuit pattern is exposed in Step S109, and a job is ended.

[0032] On the other hand, alarm is outputted when it progresses to Step S110. Next, in Step S111, the newest atmospheric pressure value registered into memory 54 is asked to centralized-control equipment 52, and the value which added **** between each projection aligner 53 to the newest atmospheric pressure value is received from centralized-control equipment 52. Next, in Step S112, with the received atmospheric pressure value, the atmospheric pressure value measured at Step S104 is replaced, and it progresses to Step S108. Therefore, at Steps S108 and S109, based on the replaced atmospheric pressure value, amendment of a focal position and a projection scale factor will be performed, and a circuit pattern will be exposed.

[0033] The reason for having adopted such processing is as follows. Atmospheric pressure is not sharply changed in the short term, although a big change in the long run is seen. Moreover, it can be guessed that atmospheric pressure change produced in a clean room is what produces the almost same atmospheric pressure change also in each projection aligner in the clean room. However, when a noise occurs according to some troubles, such as a poor contact of a cable connector, in a projection aligner, a barometer may gather the noise, and may malfunction and 1.5hpa(s) may also change for a short time. Such change can be clearly regarded as a malfunction.

[0034] Then, the amount of change of the atmospheric pressure in the short period of time measured and obtained is checked, and when it becomes more than fixed [the amount of change is], it is made to regard it as the abnormalities of Barometers 19A and 19B in this example. That is, in case abnormalities

are judged, or change of the measurement value of atmospheric pressure will not be based on failure of the meter itself by using the difference of the measurement value by two sets of the barometers 19A and 19B in a projection aligner, and the difference of the measurement value of this time and last time, it is made to judge whether it is what is depended on an external factor (Steps S105 and S106). This is bearing a role of one information which shortens time to a failure return while it is useful to a subsequent cause investigation.

[0035] However, stopping equipment immediately, when barometer 19A and/or 19B are judged to be unusual, and stopping production is connected with reducing productivity. Consequently, a production schedule may be unable to be attained. Then, in this example, further, in order to make a halt of equipment avoid, processing continuation is enabled between 1 commuter's tickets by substituting for the atmospheric pressure value of other aligners (Steps S111 and S112), and performing focal position amendment and projection scale-factor amendment temporarily.

[0036] Although it is made to transmit the value which centralized-control equipment 52 registered the atmospheric pressure value from each projection aligner 53, and added **** between each projection aligner 53 to the newest atmospheric pressure value to the semiconductor aligner 53 with the inquiry in the 1st example of the [example 2] above The atmospheric pressure sensor 55 is formed in the centralized-control equipment 52 of drawing 3 , and it is made to instead transmit the same atmospheric pressure value to all the projection aligners 53 by this example. And the atmospheric pressure value measured by the atmospheric pressure sensor 55 connected to centralized-control equipment 52 was always transmitted to each projection aligner 53, or it has the means which can choose whether the atmospheric pressure value of each projection aligner 53 transmits the newest atmospheric pressure value managed with centralized-control equipment 52 only at the time of abnormalities, and an atmospheric pressure value is transmitted to each projection aligner 53 according to the setup.

[0037] [Example 3] drawing 4 is the perspective diagram showing the appearance of the semiconductor aligner concerning the 3rd example of this invention. As shown in this drawing, this semiconductor aligner is arranged to the ** tone chamber 101 which performs environmental temperature control of the main part of equipment, and its interior. In the EWS main part 106 and row which have CPU which controls the main part of equipment In the display unit 102 for EWS and the main part of equipment which display the predetermined information in equipment It has the console section containing the control panel 103 for performing a predetermined input to the monitor TV 105 which displays the image information obtained through an image pck-up means, and equipment, and the keyboard 104 grade for EWS. For an emergency stop switch and 109, as for a LAN telecommunication cable and 111, 110, such as various switches and a mouse, is [107 / an ON-OFF switch and 108 / the jet pipe of generation of heat from a console function and 112] the exhausts of a chamber among drawing. A semiconductor aligner main part is installed in the interior of a chamber 101.

[0038] The display 102 for EWS is a thing thin shape flat type [, such as EL, plasma, and liquid crystal,], is dedicated to chamber 101 front face, and is connected with the EWS main part 106 by the LAN cable 110. A control panel 103, a keyboard 104, and monitor TV105 grade are also installed in chamber 101 front face, and enable it to have performed the same console operation as usual from chamber 101 front face.

[0039] Drawing 5 is drawing showing the internal structure of the equipment of drawing 4 . The stepper as a semiconductor aligner is shown in this drawing. Among drawing, a reticle and 203 are wafers, and 202 can imprint the pattern on a reticle 202 to the photosensitive layer on a wafer 203 with the projection lens 206, when the flux of light which came out of light equipment 204 illuminates a reticle 202 through the lighting optical system 205. The reticle 202 is supported by the reticle stage 207 for holding a reticle 202 and moving. A wafer 203 is exposed after vacuum adsorption has been carried out by the wafer chuck 291. The wafer chuck 291 is movable to each shaft orientations with the wafer stage 209. The reticle optical system 281 for detecting the amount of position gaps of a reticle is arranged at the reticle 202 bottom. The projection lens 206 is adjoined above the wafer stage 209, and the off-axis microscope 282 is arranged. It is a main role that the off-axis microscope 282 performs relative-position detection with an internal reference mark and the alignment mark on a wafer 203. Moreover, these

stepper main part is adjoined, the reticle library 220 and the wafer carrier elevator 230 which are a peripheral device are arranged, and a required reticle and a required wafer are conveyed by the reticle transport device 221 and the wafer transport device 231 at a stepper main part.
[0040] The chamber 101 is constituted by the filter box 213 which filters the air-conditioning cabin 210 and minute foreign matter which mainly perform temperature control of air, and forms the uniform flow of pure air, and the booth 214 which intercepts equipment environment with the exterior in a row. Within a chamber 101, the air by which temperature control was carried out at the condensator 215 and the reheat heater 216 in the air-conditioning cabin 210 is supplied in a booth 214 through an air filter g by the blower 217. The air supplied to this booth 214 is again incorporated from the return mouth ra in the air-conditioning cabin 210, and circulates through the inside of a chamber 101. Usually, strictly, this chamber 101 has introduced the air outside the booth 214 of about ten percent of the amount of recirculating airs through a blower from the open air inlet oa in which it was prepared in the air-conditioning cabin 210, in order to always maintain the inside of not the perfect circulatory system but the booth 214 at a positive pressure. Thus, it makes it possible for a chamber 101 to keep constant the environmental temperature on which this equipment is put, and to keep air pure. Moreover, in preparation for cooling of a ultrahigh pressure mercury lamp, or poisonous gas generating at the time of laser abnormalities, an inlet port sa and an exhaust port ea are formed in light equipment 204, and the forcible exhaust air of a part of air in a booth 214 is carried out via light equipment 204 at the plant through the ventilating fan of the exclusive use with which the air-conditioning cabin 210 was equipped. Moreover, it connected with the open air inlet oa and the return mouth ra of the air-conditioning cabin 210, respectively, and they are equipped with the chemisorption filter cf for removing the chemical in air.
[0041] Drawing 6 is the block diagram showing the electrical circuit composition of the equipment of drawing 4 . In this drawing, 301 is the main part CPU which manages control of the whole equipment, and consists of central arithmetic units, such as a microcomputer or a minicomputer. 302 -- for a reticle-stage driving gear and 305, as for a shutter driving gear and 307, illumination systems, such as light equipment, and 306 are [a wafer stage driving gear and 303 / alignment detection systems, such as an off-axis microscope and 304 / a focal detection system and 308] Z driving gears, and these are controlled by the main part CPU 301 For 309, as for an atmospheric pressure sensor and 311, conveyance systems, such as a reticle transport device and a wafer transport device, and 310 are [a temperature sensor and 312] humidity sensors.
[0042] 300 is a console unit which has auxiliary memory 314, a display 317, a keyboard 316, and external storage 315, and is for giving various kinds of commands and parameters about operation of this aligner to a main part CPU 313. That is, it is for delivering and receiving information among operators. Auxiliary memory 314 is a hard disk, the database is built inside and various parameters, the management data of those, etc. are recorded. As external storage 315, things, such as FDD (floppy disk drive) and MOD (Magnetic-Optical disk drive), can be considered. 318 may use the protocol which has spread generally [NetWare etc.], although it is a network interface and standard network protocols, such as TCP/IP, are used in many cases as a protocol in the case of communicating. A program and data read the data stored in media from external storage 315, and are saved at auxiliary memory 314.
[0043] This semiconductor aligner must keep constant environmental values, such as atmospheric pressure in equipment, temperature, and humidity, in order to carry out highly precise semiconductor exposure. However, these environmental values tend to receive the environmental influence besides aligners, such as change of change of the atmospheric pressure by the weather, the room temperature in a clean room, and humidity. Therefore, it was conventionally difficult to judge immediately whether it is what depends whether it is failure of a control apparatus and the measurement sensor of atmospheric pressure sensor 310 grade about the environment of the air-conditioning machine in an aligner etc. though these environmental values in an aligner show outlying observation on the environmental variation besides an aligner.
[0044] Then, in this example, as shown in drawing 7 , two or more semiconductor aligners 404 of the same model installed in the clean room 401 are connected with the network communication network 402

through a network interface 318, and environmental values, such as mutual atmospheric pressure, temperature, and humidity, are mutually checked between each aligner 404. And when the environmental value of all the aligners 404 changes similarly It tells that the environmental value change judged it as the thing resulting from the environmental variation besides an aligner 404, and abnormalities arose to the operator at the environment besides an aligner 404. It tells that judged only the specific aligner 404 that abnormalities occurred in the aligner 404, and abnormalities produced it within the aligner 404 to the operator when the environmental value was changing. Moreover, when the value in which two or more environmental values, such as atmospheric pressure in a certain aligner 404, temperature, and humidity, differ from other aligners 404 is shown, it judges that abnormalities occurred in the function of the chamber of the aligner 404, and an operator is told about abnormalities having arisen within the aligner 404. In addition, the semiconductor aligner 404 is explained using drawing 4 - 6.

[0045] Drawing 8 is a flow chart which shows operation of the aligner 404 for performing such processing. If processing is started as shown in this drawing, in Step 501, it will judge whether the environmental value influenced of environmental variations, such as atmospheric pressure, temperature, and humidity, for every fixed time is acquired, and the environmental value of all aligners is changing from the aligner 404 of all the same models on a network similarly in Step 502. When it judges with the environmental value of all the aligners 404 changing similarly, possibility that progress to Step 510, and the environment besides an aligner is changing, or abnormalities have arisen in the environmental control facility besides an aligner tells an operator about a high thing, and ends processing. For example, it judges that change of the weather has taken place when the atmospheric pressure of all the aligners 404 is changing at same rate, and when temperature is changing at same rate, it is judged that abnormalities may have occurred in the environmental control of a clean room 401.

[0046] In Step 502, when it judges with not all the environmental value of aligners changing similarly, it progresses to Step 503 and judges whether there is any different environmental value from other aligners. When it judges with it returning to Step 501 when it judges with there being no environmental value which is different from other aligners here, and there being a different environmental value, it progresses to Step 504. At Step 504, it judges whether it differs from other aligners about other environmental values. If other environmental values differ, in Step 505, it will judge that abnormalities occurred to the environmental control equipment in an aligner, and will progress to Step 507. Otherwise, in Step 506, it judges that they are the abnormalities of the sensor which measures the environmental value, and progresses to Step 507.

[0047] For example, the chamber equipment which controls air-conditioning in Step 506 when it judges with the temperature in an aligner being outlying observation in Step 503 and judges with humidity being outlying observation in Step 504 is unusual, and when it judges with humidity being normal in Step 504, in Step 506, a temperature sensor judges that it is unusual.

[0048] At Step 507, if it is not less than constant value, after it judges whether a difference with the environmental value in other aligners is less than constant value, it displays a warning message by step 508 HE **** with constant value [less than], and displaying an error message in Step 509, processing is ended.

[0049] Drawing 9 is a flow chart which shows the processing about a vacuum ** value in which a wafer is adsorbed. If processing is started as shown in this drawing, in Step 601, it will judge whether vacuum ** is acquired for every fixed time, and vacuum ** of all aligners is changing from the aligner of all the same models on a network similarly in Step 602. If it is changing similarly, it will progress to Step 610, an operator will be told about possibility that abnormalities have arisen to the compressor which controls vacuum ** in a clean room being high, and processing will be ended. If it is not changing similarly, it will progress to Step 603 and will judge whether the value in which vacuum ** in an aligner differs from other aligners was shown. When it returns to Step 601 when a different value is not shown, and a different value is shown, in Step 604, it judges whether vacuum ****** differs from other aligners. If it differs, it judges that abnormalities occurred in the vacuum mechanism in an aligner in Step 605, and progresses to Step 607, and if it does not differ, after judging that they are the abnormalities of a vacuum

****** sensor in Step 606, it will progress to Step 607.
[0050] At Step 607, if it is not below constant value, after the difference of vacuum ** with other aligners judges whether it is below constant value, with constant value [below] it displays a warning message in Step 608, and it ends processing, and expressing an error message as Step 609, processing is ended.
[0051] The example of the device manufacture method of having used the <example of the device manufacture method> next the aligner which gave [above-mentioned] explanation, or the aligner system is explained. Drawing 10 shows the flow of manufacture of minute devices (semiconductor chips, such as IC and LSI, a liquid crystal panel, CCD, the thin film magnetic head, micro machine, etc.). The pattern design of a device is performed at Step 1 (circuit design). The mask in which the designed pattern was formed is manufactured at Step 2 (mask manufacture). On the other hand, at Step 3 (wafer manufacture), a wafer is manufactured using material, such as silicon and glass. Step 4 (wafer process) is called last process, and forms an actual circuit on a wafer with lithography technology using the mask and wafer which carried out [above-mentioned] preparation. The following step 5 (assembly) is called back process, is a process semiconductor-chip-ized using the wafer produced by Step 4, and includes processes, such as an assembly process (dicing, bonding) and a packaging process (chip enclosure). At Step 6 (inspection), the check test of the semiconductor device produced at Step 5 of operation, an endurance test, etc. are inspected. Through such a process, a semiconductor device is completed and this is shipped (Step 7).
[0052] Drawing 11 shows the detailed flow of the above-mentioned wafer process (Step 4). The front face of a wafer is oxidized at Step 11 (oxidization). An insulator layer is formed in a wafer front face at Step 12 (CVD). At Step 13 (electrode formation), an electrode is formed by vacuum evaporationo on a wafer. Ion is driven into a wafer at Step 14 (ion implantation). A resist is applied to a wafer at Step 15 (resist processing). At Step 16 (exposure), by the aligner or the exposure method which gave [above-mentioned] explanation, the circuit pattern of a mask is arranged in two or more shot fields of a wafer, and printing exposure is carried out. The exposed wafer is developed at Step 17 (development). At Step 18 (etching), portions other than the developed resist image are shaved off. The resist which etching could be managed with Step 19 (resist ablation), and became unnecessary is removed. By carrying out by repeating these steps, a circuit pattern is formed on a wafer multiplex. If the process of this example is used, the large-sized device for which manufacture was difficult can be conventionally manufactured to a low cost.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the important section schematic diagram of the projection aligner concerning the 1st example of this invention.
[Drawing 2] It is the flow chart which shows operation of the equipment of drawing 1 .
[Drawing 3] It is the block diagram showing the outline of the aligner system equipped with two or more projection aligners of drawing 1 .
[Drawing 4] It is the perspective diagram showing the appearance of the semiconductor aligner concerning the 3rd example of this invention.
[Drawing 5] It is drawing showing the internal structure of the equipment of drawing 4 .
[Drawing 6] It is the block diagram showing the electrical circuit composition of the equipment of drawing 4 .
[Drawing 7] It is the block diagram showing the outline of the aligner system containing the equipment of drawing 4 .
[Drawing 8] It is the flow chart which shows operation of the aligner in the system of drawing 7 .
[Drawing 9] It is the flow chart which shows the processing about a vacuum ** value in which the wafer in the aligner in the system of drawing 7 is adsorbed.
[Drawing 10] It is the flow chart which shows the device manufacture method that the aligner of this invention can be used.
[Drawing 11] It is the detailed flow chart of the wafer process in drawing 10 .
[Description of Notations]
A reticle, 2:reticle chuck, 3:reticle driving gear, 4 : 1: A reticle stage, 5: A projection lens system, 6A, a 6B:field lens, 7 : A lens system, 8: A lens driving gear, 9:wafer, 10:wafer chuck, 11 : A wafer driving gear, 12: A wafer stage, 13:reticle drive control system, 14 : A wafer drive control system, 15: A reticle position transducer, 16:lens drive control system, 17 : A lens position transducer, 18: A focal position transducer, 19A, a 19B:atmospheric pressure sensor, 20 : A temperature sensor, 21 : A humidity sensor, 22:lens temperature sensor, 23:microprocessor, 24 : An illumination system, 25:condensing lens, 26:mirror, 27:laser light source, 28 : A laser cavity, 29:wavelength-selection element, 30:wavelength-selection element driving gear, 31: A wavelength-selection element angle detector, 32:wavelength-selection element drive control system, 40 : A memory apparatus, 41: Alarm equipment, 51:network, 52:centralized-control equipment, 53 : A projection aligner, 54 : A memory apparatus, 55:atmospheric pressure sensor, a 300:console unit, 301: A main part CPU, the 313:console CPU, 317 : A display, 310: An atmospheric-pressure sensor, a 311:temperature sensor, a 312:humidity sensor, a 318:network interface, a 401:clean room, a 402:network-communication network, 404: Semiconductor aligner.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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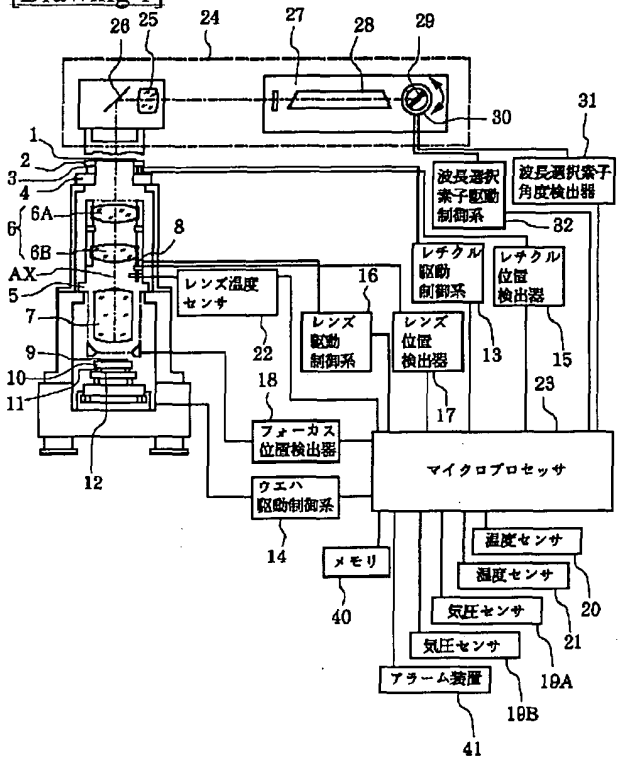
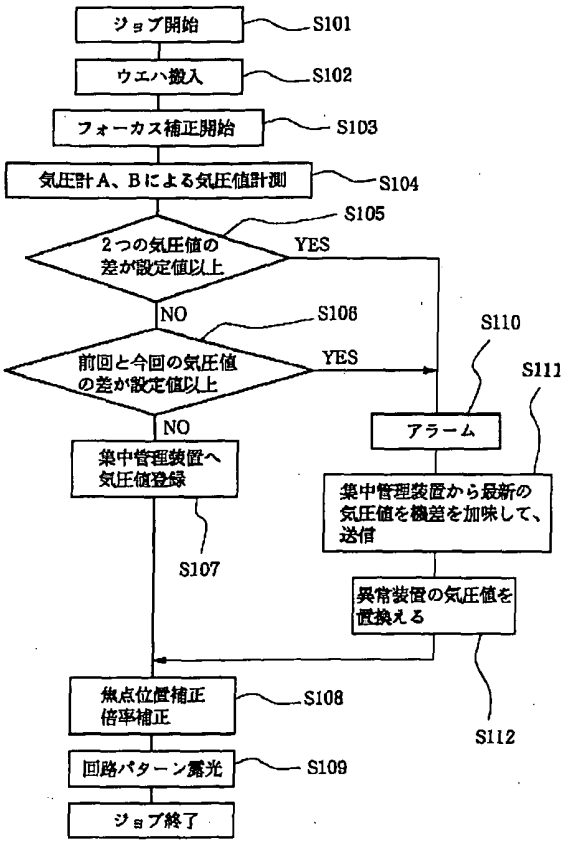
DRAWINGS

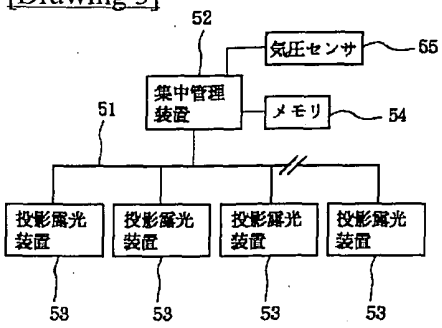
[Drawing 1]



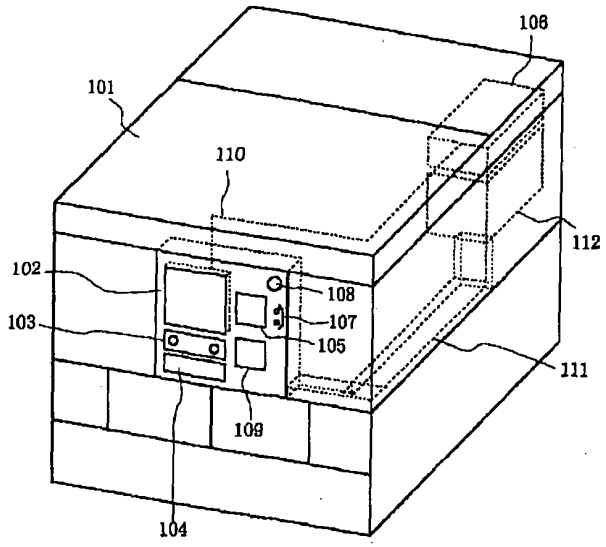
[Drawing 2]



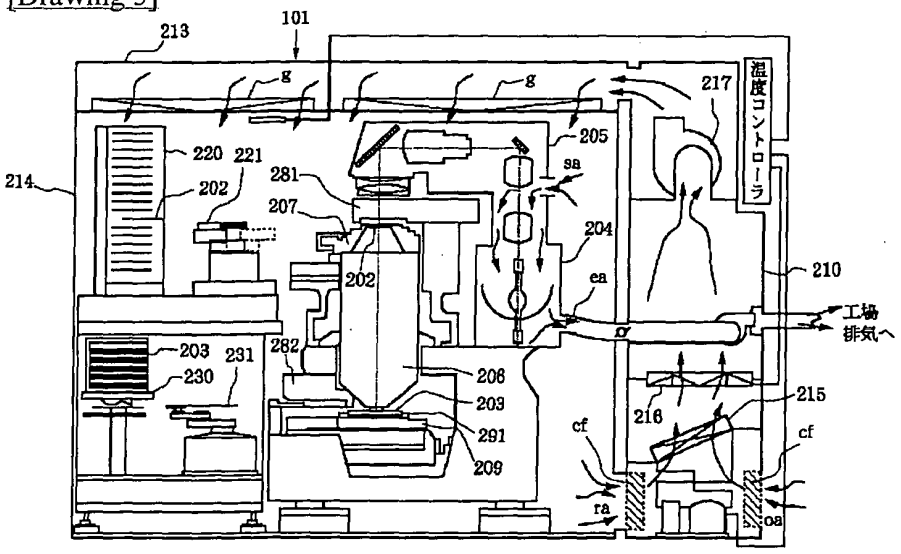
[Drawing 3]



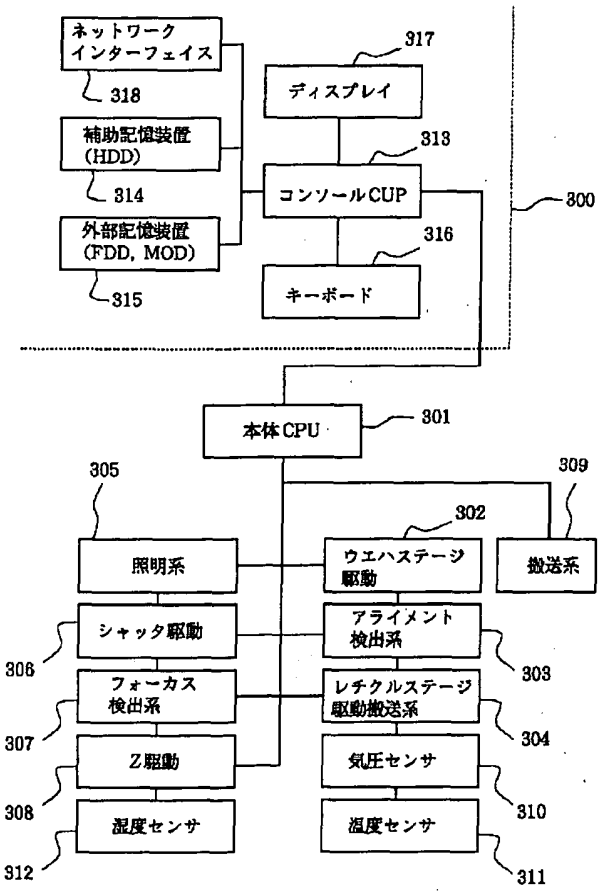
[Drawing 4]



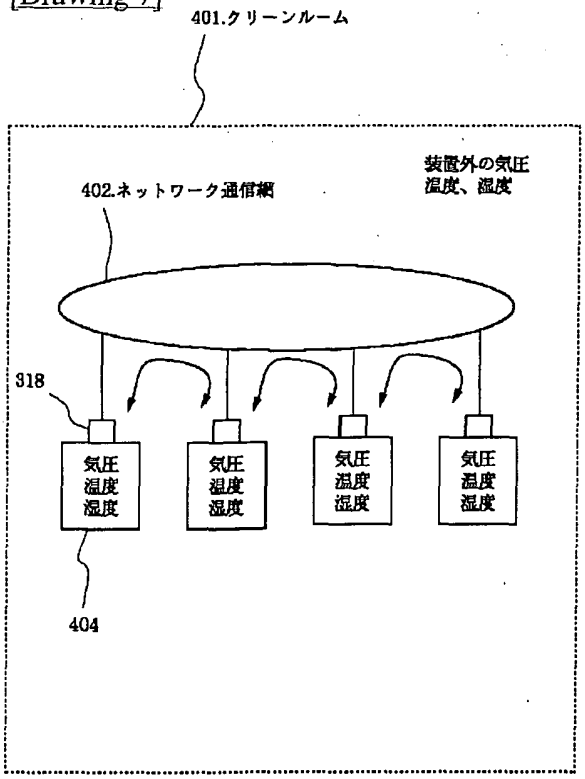
[Drawing 5]



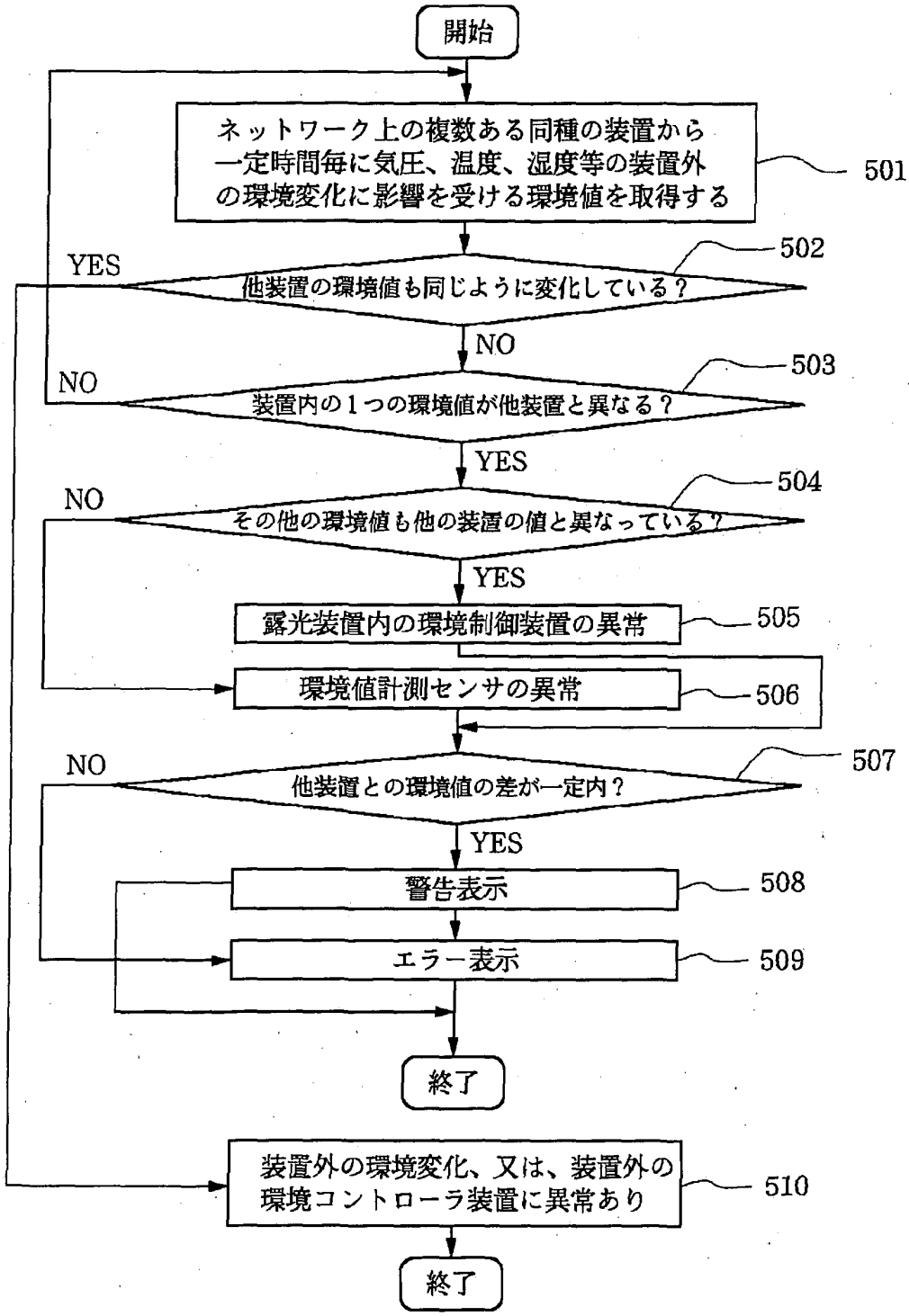
[Drawing 6]



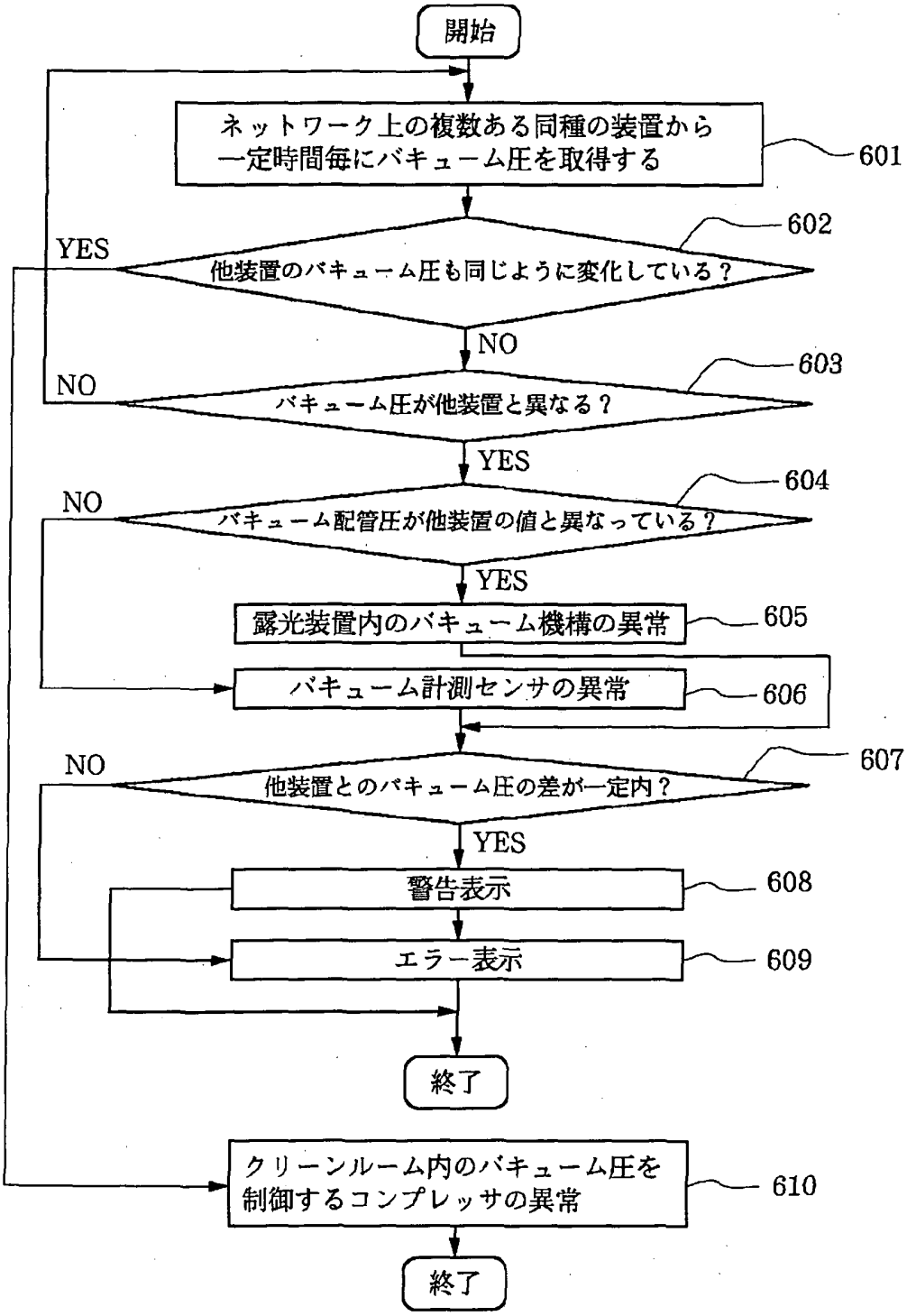
[Drawing 7]



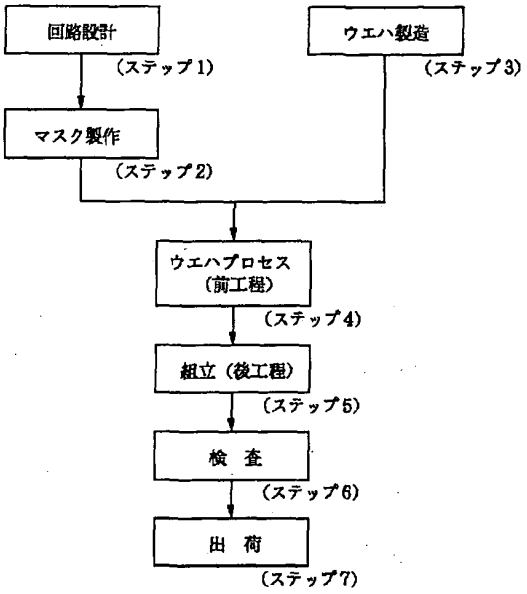
[Drawing 8]


開始
ネットワーク上の複数ある同種の装置から
一定時間毎に気圧、温度、湿度等の装置外
の環境変化に影響を受ける環境値を取得する
501
YES
他装置の環境値も同じように変化している？
502
NO
NO
装置内の１つの環境値が他装置と異なる？
503
YES
NO
その他の環境値も他の装置の値と異なっている？
504
YES
露光装置内の環境制御装置の異常
505
環境値計測センサの異常
506
NO
他装置との環境値の差が一定内？
507
YES
警告表示
508
エラー表示
509
終了
装置外の環境変化、又は、装置外の
環境コントローラ装置に異常あり
510
終了

[Drawing 9]

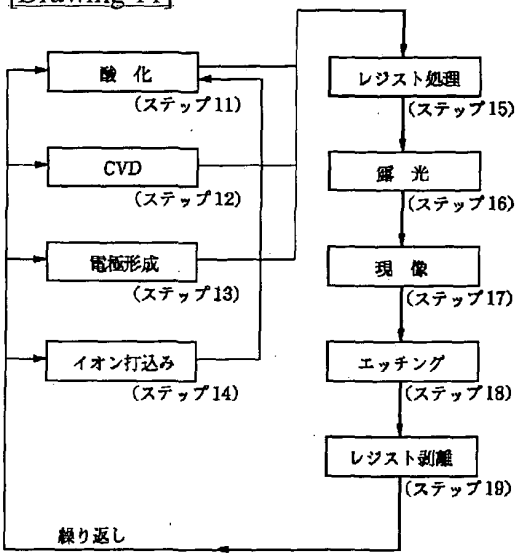

開始
ネットワーク上の複数ある同種の装置から
一定時間毎にバキューム圧を取得する
601
他装置のバキューム圧も同じように変化している？
602
YES
NO
バキューム圧が他装置と異なる？
603
NO
YES
バキューム配管圧が他装置の値と異なっている？
604
NO
YES
露光装置内のバキューム機構の異常
605
バキューム計測センサの異常
606
他装置とのバキューム圧の差が一定内？
607
NO
YES
警告表示
608
エラー表示
609
終了
クリーンルーム内のバキューム圧を
制御するコンプレッサの異常
610
終了

[Drawing 10]



半導体デバイス製造フロー

[Drawing 11]



ウエハプロセス

[Translation done.]

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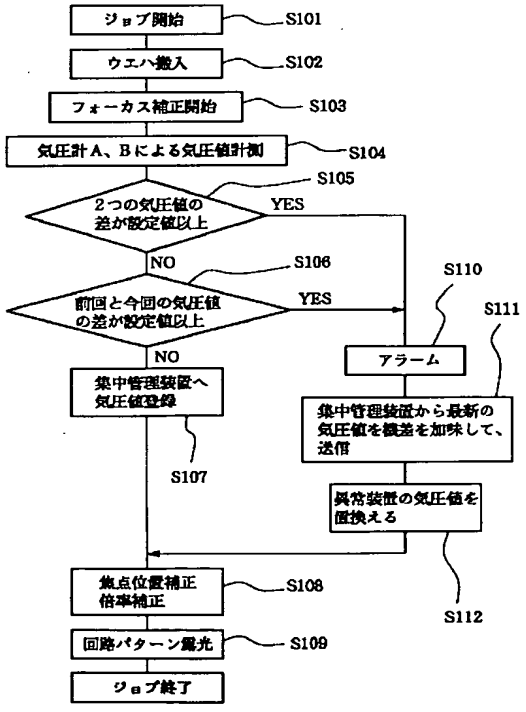
(54)【発明の名称】　露光装置、露光装置システムおよびデバイス製造方法

(57)【要約】
【課題】　気圧等の測定手段が異常値を示した場合に、その異常値が測定手段の故障によるものである場合を区別し、さらには装置の他の部分の故障である場合を区別できるようにする。また、異常値が測定手段の故障によるものである場合でも、装置の動作を続行できるようにする。
【解決手段】　装置における所定の測定対象についての測定手段と、この測定結果に基づいて装置が異常な状態の下で動作するのを防止するようにした露光装置５３において、他の装置５２、５３における測定結果をも参照して装置の異常な状態での動作を防止する。さらにかかる露光装置と管理装置とでコンピュータネットワークを構成した露光装置システムにおいて、管理装置５２は、各露光装置５３に対して所定の計測対象についての計測を指示し、これに応じて計測された各露光装置における計測値を受信して登録する。管理装置は各露光装置から計測対象について計測値の問い合せがあったときは、これに応じて、登録してある計測値のうちの最新のものをその露光装置に送信する。



1

【特許請求の範囲】

【請求項１】　装置における所定の測定対象について測定を行なう測定手段と、この測定結果に基づいて装置が異常な状態の下で動作するのを防止する異常動作防止手段とを備えた露光装置において、前記異常動作防止手段は、前記測定対象についての他の装置における測定結果をも参照して前記装置の異常な状態での動作を防止するものであることを特徴とする露光装置。

【請求項２】　前記他の装置は、ともにコンピュータネットワークを構成している他の露光装置またはそのネットワークに含まれる露光装置を管理する管理装置であることを特徴とする請求項１に記載の露光装置。

【請求項３】　前記異常動作防止手段は、前記管理装置が、前記ネットワークに含まれる露光装置からあるいは自身の測定手段により取得して保持している前記測定対象についての最新の測定結果を参照するものであることを特徴とする請求項２に記載の露光装置。

【請求項４】　前記測定対象には気圧が含まれ、前記異常動作防止手段は、前記管理装置から最新の気圧についての測定結果の供給を受け、それに基づき、露光に際しての投影倍率および焦点位置の補正を行なうものであることを特徴とする請求項３に記載の露光装置。

【請求項５】　前記供給を受ける測定結果は、前記ネットワークに含まれる露光装置間の機差が考慮されていることを特徴とする請求項４に記載の露光装置。

【請求項６】　前記測定手段は気圧を測定するものであり、前記異常動作防止手段は、前記測定手段による気圧の測定結果が異常であり、その異常が前記測定手段によるものである場合は、その代替として、前記測定結果の供給を受けるものであることを特徴とする請求項４または５に記載の露光装置。

【請求項７】　前記測定対象についての測定結果を前記管理装置に送信する送信手段を有することを特徴とする請求項２～６のいずれか１項に記載の露光装置。

【請求項８】　前記送信手段は、前記測定結果の送信に際しては、装置の番号および計測日時を含めて送信を行なうものであることを特徴とする請求項７に記載の露光装置。

【請求項９】　前記測定対象には、気圧、温度もしくは湿度、または被露光基板を露光時に吸着し、保持するためのバキューム圧が含まれることを特徴とする請求項１～８のいずれか１項に記載の露光装置。

【請求項１０】　前記異常動作防止手段は、前記測定手段による測定結果に基づいて異常を検出する異常検出手段を備えることを特徴とする請求項１～９のいずれか１項に記載の露光装置。

【請求項１１】　前記測定手段は同種の測定対象について測定を行なう２つの測定手段であり、前記異常検出手段は、これらの測定手段による測定値の差が所定の範囲を超えた場合にその測定手段のうちのいずれかが異常であると判断するものであることを特徴とする請求項１０に記載の露光装置。

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【請求項１２】　前記異常検出手段は、前記測定手段による今回の測定結果と所定の期間前に行なった前回の測定結果との差が所定の範囲を超えている場合に前記測定手段が異常であると判断するものであることを特徴とする請求項１０または１１に記載の露光装置。

【請求項１３】　前記異常動作防止手段は、前記異常検出手段が異常を検出した場合は、その旨の警告もしくはエラーの出力または表示を行なうものであることを特徴とする請求項１０～１２のいずれか１項に記載の露光装置。

【請求項１４】　前記異常検出手段は、前記測定手段によるその測定対象についての測定結果、および装置が属するコンピュータネットワーク上の他の同種の露光装置における前記測定対象と同種の測定対象についての測定結果に基づいて前記異常の検出を行なうものであることを特徴とする請求項１０～１３のいずれか１項に記載の露光装置。

【請求項１５】　前記同種の露光装置は同一のクリーンルーム内に設置されており、前記異常検出手段は、装置内の前記測定手段による測定結果および前記同種の露光装置における同種の測定対象、あるいはさらに前記クリーンルームの環境を制御する環境制御装置における同種の測定対象についての測定結果が同様に異常な変化を示しているときは装置外の異常であり、装置内の前記測定手段による測定結果のみが異常な変化を示しているときは装置内部における異常であると判断するものであることを特徴とする請求項１４に記載の露光装置。

【請求項１６】　前記異常検出手段は、前記装置内部における異常であると判断する場合において、装置内の相互に関連する異なる測定対象についての複数の前記測定手段による測定結果が同様に異常な変化を示しているときは、それらの測定手段が関係する装置内の部分が異常であり、１つの測定手段による測定結果のみが異常な変化を示しているときは、その測定手段が異常であると判断するものであることを特徴とする請求項１５に記載の露光装置。

【請求項１７】　コンピュータネットワークを構成している、露光装置およびこれを管理する管理装置を備えた露光装置システムにおいて、前記管理装置は、各露光装置に対して所定の計測対象についての計測を指示する指示手段と、これに応じて計測された各露光装置における計測値を受信して登録する登録手段とを具備することを特徴とする露光装置システム。

【請求項１８】　前記管理装置は、登録した各露光装置の計測値に基づいて各投影露光装置間の計測値の機差を求める手段を有することを特徴とする請求項１７に記載の露光装置システム。

【請求項１９】　前記管理装置は、各露光装置から、前

記計測対象についての最新の計測値の問い合せがあったときは、これに応じて、前記登録手段により登録してある計測値のうちの最新のものをその露光装置に送信するものであることを特徴とする請求項１７または１８に記載の露光装置システム。

【請求項２０】　前記管理装置は、前記計測値に付随させて登録してある計測日時の情報に基づいて前記最新の計測値を抽出するものであることを特徴とする請求項１９に記載の露光装置システム。

【請求項２１】　前記管理装置は、前記計測値の送信を行なう際には、前記登録してある計測値から得た各露光装置間での機差を考慮した計測値を送信するものであることを特徴とする請求項１９または２０に記載の露光装置システム。

【請求項２２】　コンピュータネットワークを構成している、露光装置およびこれを管理する管理装置を備えた露光装置システムにおいて、前記管理装置は、所定の測定対象について測定を行なう測定手段を備え、この測定手段による測定結果を、前記ネットワークを介して、各露光装置に送信するものであることを特徴とする露光装置システム。

【請求項２３】　前記管理装置は、各露光装置から前記測定対象についての測定結果の問い合せがあった場合にその露光装置に対して、または常に各露光装置に対して、前記測定結果の送信を行なうものであり、これらのうちのいずれの方法で前記送信を行なうかが設定可能であることを特徴とする請求項２２に記載の露光装置システム。

【請求項２４】　前記露光装置は、請求項１～１６のいずれかの露光装置であることを特徴とする請求項１７～２３のいずれか１項に記載の露光装置システム。

【請求項２５】　露光装置における所定の測定対象について測定を行ない、この測定結果に基づいて前記露光装置が異常な状態の下で動作するのを防止しながら前記露光装置により露光を行なうことによりデバイスを製造するデバイス製造方法において、前記測定対象についての他の露光装置または他の装置における測定結果をも参照して前記露光装置の異常な状態での動作を防止することを特徴とするデバイス製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、装置における所定の測定対象について測定を行ない、この測定結果に基づいて装置が異常な状態の下で動作するのを防止するようにした露光装置、これを有する露光装置システムおよびこれらを用いることができるデバイス製造方法に関する。

【０００２】

【従来の技術】近年、ＩＣ、ＬＳＩ等の半導体デバイスの高集積化に対する要求に応じて、その高集積化がますます加速度を増している。マスク（レチクル）の回路パターン像を投影光学系により感光基板上に形成し、感光基板をステップアンドリピート方式で露光する縮小型の投影露光装置（ステッパ）においても解像度の向上のために様々な改良がなされている。

【０００３】レチクル面上のパターンをウエハ面上に縮小投影する投影光学系の光学性能（結像倍率や結像性能）は環境変化、例えば気圧変化により種々に変化する。最近の高解像力が要望されている投影露光装置では、気圧の変化により発生する光学性能の誤差は大きな問題点となっており、この光学性能の誤差を補正して投影することが重要になっている。

【０００４】これを解決するため、特開平０６－３４２７５５号公報においては、半導体ウエハが載置されるテーブルと、照明光学系と、所望の転写パターンを有するレチクルと、複数のレンズを含むレンズ群からなり、前記転写パターンを前記半導体ウエハの一主面に投影する投影光学系と、前記レチクルまたは前記投影光学系における前記レチクル側の前記レンズを移動させることで前記半導体ウエハに対する前記転写パターンの投影倍率を調整する倍率調整機構と、前記投影光学系の前記半導体ウエハに対する焦点位置を調整する焦点位置調整機構とを有する縮小投影露光装置を用いた縮小投影露光方法であって、大気圧または前記縮小投影露光装置の環境気圧の変動を検出する第１の段階と、前記大気圧または環境気圧の変動に応じて前記投影光学系と前記テーブルとの距離を相対的に変化させる焦点位置調整機構により、前記倍率調整機構による前記投影倍率の調整操作とは独立に前記投影光学系の前記半導体ウエハに対する焦点位置を調整する操作を行なう第２の段階と、前記レチクルの前記転写パターンを前記半導体ウエハに転写する第３の段階とからなることを特徴とする投影露光方法が提案されている。

【０００５】また、特開平０８－３０５０３４号公報においては、第１物体のパターンを投影光学系により第２物体上に投影する装置において、前記投影光学系に関連する気圧の変化を検出する気圧検出手段と、前記第１物体のパターンの投影に用いる光の波長を変える波長変更手段と、前記気圧検出手段の出力を受け、前記気圧の変化による前記投影光学系の硝材の相対屈折率の変化を補正するように前記第１物体のパターンの投影に用いる光の波長を変える波長変更手段とを有することを特徴とする投影露光方法が提案されている。これらの方法により、レチクル面上のパターンを投影光学系によってウエハ面上に投影する際、日常の気圧変動や設置場所の大気圧に対応する光学性能の変動を、適切に設定した気圧測定手段や調整機構を用いることにより良好に補正し、高い光学性能が容易に得られる投影露光装置およびそれを用いたデバイスの製造方法を達成することができる。

【０００６】

【発明が解決しようとする課題】しかしながら、補正量を決める上で基となる情報を提供する気圧測定手段が、電気的なノイズなどの要因で、誤動作し、異常値を計測してしまうことが希にある。それに気づかず、投影露光装置が、気圧測定手段が計測した異常値に基づいて、焦点調整機構や倍率調整機構を用いて、焦点位置や投影倍率を補正してしまうと、半導体ウエハに転写したパターンが不良となってしまうという問題が発生する。また、半導体露光装置は、非常に複雑かつ精密な装置であるため、半導体を露光する場合、気圧以外にも、装置内の温度、湿度等の環境を一定範囲内に保つ必要がある。そこで、従来、それらの環境値が一定範囲外になった場合は、装置に何らかの異常が発生したと判断しているが、気圧、温度等の環境値は、天候やクリーンルーム環境等、装置外の環境の影響を受ける場合があり、異常値になったとしても必ずしも当該装置の故障だとは限らない。かかる場合、現状では、装置外の環境の変化による異常かどうかの判断を下すことは困難である。

【０００７】本発明の目的は、上述従来技術の問題点に鑑み、露光装置、露光装置システムおよびデバイス製造方法において、第１に、異常な状態における装置の稼動を防止するために、気圧等の測定手段が異常値を示した場合に、その異常値が測定手段の故障によるものである場合を区別し、さらには装置の他の部分の故障である場合を区別できるようにすることにある。第２に、異常値が測定手段の故障によるものである場合でも、装置の動作を停止させることなく、デバイス製造を続行できるようにすることにある。

【０００８】

【課題を解決するための手段】この目的を達成するため本発明の露光装置は、装置における所定の測定対象について測定を行なう測定手段と、この測定結果に基づいて装置が異常な状態の下で動作するのを防止する異常動作防止手段とを備えた露光装置において、前記異常動作防止手段は、前記測定対象についての他の装置における測定結果をも参照して前記装置の異常な状態での動作を防止するものであることを特徴とする。この構成において、測定手段が異常な測定値を示した場合、その原因は、他の装置における測定結果をも参照して判断され、この結果に基づいて、異常な状態下での動作の続行が防止される。したがって、異常値が装置自身に起因するものか、装置外の原因によるものか等が適切に判断され、異常値が装置の計測手段の異常による場合は他の装置における測定結果を代替値として使用して動作を続行する等の、適切な対応がなされる。

【０００９】また、本発明の露光装置システムは、コンピュータネットワークを構成している、露光装置およびこれを管理する管理装置を備えた露光装置システムにおいて、前記管理装置は、各露光装置に対して所定の計測対象についての計測を指示する指示手段と、これに応じて計測された各露光装置における計測値を受信して登録する登録手段とを具備することを特徴とする。この構成において、管理装置が各露光装置から取得し、登録した計測値は、種種の形態で利用される。例えば、ある露光装置における所定の計測対象についての計測値が異常である場合は、その代替値として、登録してある最新の計測値がその露光装置に供給される。あるいは、登録してある測定値に基づき、ある露光装置における所定の計測対象についての異常な計測値がその装置に起因するものかどうかが的確に判断される。

【００１０】また、本発明の別の露光装置システムは、コンピュータネットワークを構成している、露光装置およびこれを管理する管理装置を備えた露光装置システムにおいて、前記管理装置は、所定の測定対象について測定を行なう測定手段を備え、この測定手段による測定結果を、前記ネットワークを介して、各露光装置に送信するものであることを特徴とする。この構成において、例えば、ある露光装置における所定の計測対象についての計測値が異常である場合は、その代替値として、管理装置において測定した最新の計測値がその露光装置に供給され、これにより、その露光装置は、動作を続行する。

【００１１】また、本発明のデバイス製造方法は、露光装置における所定の測定対象について測定を行ない、この測定結果に基づいて前記露光装置が異常な状態の下で動作するのを防止しながら前記露光装置により露光を行なうことによりデバイスを製造するデバイス製造方法において、前記測定対象についての他の露光装置または他の装置における測定結果をも参照して前記露光装置の異常な状態での動作を防止することを特徴とする。この構成においても、本発明の露光装置と同様に、異常値が装置自身に起因するものか、装置外の原因によるものか等が適切に判断され、異常値が装置の計測手段の異常による場合は他の装置における測定結果を代替値として使用して動作を続行する等の、適切な対応がなされる。

【００１２】

【発明の実施の形態】本発明の露光装置における好ましい実施形態においては、前記他の装置は、ともにコンピュータネットワークを構成している他の露光装置またはそのネットワークに含まれる露光装置を管理する管理装置であり、異常動作防止手段は、管理装置が、前記ネットワークに含まれる露光装置からあるいは自身の測定手段により取得して保持している前記測定対象についての最新の測定結果を参照する。測定対象には気圧が含まれ、異常動作防止手段は、管理装置から最新の気圧についての測定結果の供給を受け、それに基づき、露光に際しての投影倍率および焦点位置の補正を行なう。その際に供給を受ける測定結果は、ネットワークに含まれる露光装置間の機差が考慮されている。異常動作防止手段は、測定手段が気圧を測定するものであり、その気圧の測定結果が異常であり、かつその異常が測定手段による

ものであるときは、その異常な測定結果の代替値として、前記測定結果の供給を受ける。また、測定対象についての測定結果を管理装置に送信する送信手段を有し、この送信手段は、測定結果の送信に際しては、装置の番号および計測日時を含めて送信を行なう。測定対象には、前記気圧のほか、温度もしくは湿度、または被露光基板を露光時に吸着し、保持するためのバキューム圧が含まれる。

【００１３】さらに、異常動作防止手段は、測定手段による測定結果に基づいて異常を検出する異常検出手段を備える。この異常検出手段は、同種の測定対象について測定を行なう２つの測定手段による測定値の差が所定の範囲を超えた場合にその測定手段のうちのいずれかが異常であると判断する。さらに、これら測定手段による今回の測定結果と所定の期間前に行なった前回の測定結果との差が所定の範囲を超えている場合にそれらの測定手段が異常であると判断する。異常動作防止手段は、異常検出手段が異常を検出した場合は、その旨の警告もしくはエラーの出力または表示を行なう。

【００１４】あるいは、異常検出手段は、測定手段によるその測定対象についての測定結果および装置が属するコンピュータネットワーク上の他の同種の露光装置における同種の測定対象についての測定結果に基づいて前記異常の検出を行なう。これら同種の露光装置は同一のクリーンルーム内に設置されており、異常検出手段は、装置内の測定手段による測定結果および他の同種の露光装置における同種の測定対象、あるいはさらに前記クリーンルームの環境を制御する環境制御装置における同種の測定対象についての測定結果が同様に異常な変化を示しているときは装置外の異常であり、装置内の測定手段による測定結果のみが異常な変化を示しているときは装置内部における異常であると判断する。異常検出手段は、装置内部における異常であると判断する場合において、装置内の相互に関連する異なる測定対象についての複数の測定手段による測定結果が同様に異常な変化を示しているときは、それらの測定手段が関係する装置内の部分が異常であり、１つの測定手段による測定結果のみが異常な変化を示しているときは、その測定手段が異常であると判断する。

【００１５】本発明の露光装置システムにおける好ましい実施形態においては、管理装置は、登録した各露光装置の計測値に基づいて各投影露光装置間の計測値の機差を求める手段を有する。また、管理装置は、各露光装置から、計測対象についての最新の計測値の問い合せがあったときは、これに応じて、登録手段により登録してある計測値のうちの最新のものをその露光装置に送信する。その際、計測値に付随させて登録してある計測日時の情報に基づいて最新の計測値を抽出する。そして、登録してある計測値から得た各露光装置間での機差を考慮した計測値を送信する。また、本発明の別の露光装置システムにおける好ましい実施形態においては、管理装置は、各露光装置から測定対象についての測定結果の問い合せがあった場合にその露光装置に対して、または常に各露光装置に対して、測定結果の送信を行なうものであり、これらのうちのいずれの方法で送信を行なうかが設定可能となっている。

【００１６】

【実施例】［実施例１］図１は、本発明の第１の実施例に係る投影露光装置の要部概略図である。同図において、１は回路パターンが描かれたレチクル、２はレチクル１を吸着保持するレチクルチャック、３はレチクルチャック２に取り付けたレチクル駆動装置、４はレチクル駆動装置３を支持するレチクルステージ、５は縮小型の投影レンズ系（投影光学系）、６Ａおよび６Ｂは各々投影レンズ系５を構成する部分レンズ系のフィールドレンズ、７は投影レンズ系５の一部を構成している単一の硝材より成るレンズ系、８はフィールドレンズ６Ａを投影レンズ系５の光軸ＡＸ方向に移動させるレンズ駆動装置、９はレジスト等の感光剤が塗布されたウエハ、１０はウエハ９を吸着保持するウエハチャック、１１はウエハチャック１０に取り付けたウエハ駆動装置、１２はウエハ駆動装置１１を支持し、投影レンズ系５の光軸ＡＸに直交する面内で移動可能なウエハステージである。

【００１７】レチクル駆動装置３およびウエハ駆動装置１１はそれぞれ、圧電素子等から成り、レチクル駆動装置３によりレチクルチャック２を投影レンズ系５の光軸ＡＸ方向に変位させてレチクル１を光軸ＡＸ方向に移動させ、ウエハ駆動装置１１によりウエハチャック１０を投影レンズ系５の光軸ＡＸ方向に変位させてウエハ９を光軸ＡＸ方向に移動させる。レンズ駆動装置８は空気圧や圧電素子等を利用してフィールドレンズ６Ａを投影レンズ系５の光軸ＡＸ方向に移動させる。レンズ駆動装置８の具体的な構造としては、特開昭６２－３２６１３号公報等に開示されているもの等を適用することができる。

【００１８】レチクル駆動装置３によるレチクルチャック２の駆動はレチクル駆動制御系１３からの信号に基づいて行なわれ、このときレチクル１の光軸ＡＸ方向の位置がレチクル位置検出器１５により検出される。また、同様にレンズ駆動装置８によるフィールドレンズ６Ａの駆動はレンズ駆動制御系１６からの信号に基づいて行なわれ、このときフィールドレンズ６Ａの光軸ＡＸ方向の位置がレンズ位置検出器１７により検出される。レチクル位置検出器１５とレンズ位置検出器１７は光学式エンコーダ等の各種の位置検出器で構成することができる。

【００１９】ウエハ駆動装置１１によるウエハチャック１０の駆動はウエハ駆動制御系１４からの信号に基づいて行なわれ、このときウエハ９（の表面）の光軸ＡＸ方向の位置はフォーカス検出器１８により検出される。フォーカス検出器１８は、この種の投影露光装置で従来か

ら使用されてきた、例えばエアセンサや光学式センサで構成されている。レチクル位置検出器１５、レンズ位置検出器１７およびフォーカス位置検出器１８からの各信号はマイクロプロセッサ２３へ入力される。

【００２０】投影レンズ系５の周囲の気圧、気温および温度の変化を検出するために気圧センサ（気圧測定手段）１９Ａおよび１９Ｂ、温度センサ２０ならびに湿度センサ２１が設けられ、また、投影レンズ系５の光吸収による温度変化を検出するためにレンズ温度センサ２２が設けられており、これら各種センサ１９Ａ、１９Ｂ、２０～２２からの信号もマイクロプロセッサ２３へ入力される。レチクル駆動制御系１３、レンズ駆動制御系１６およびウエハ駆動制御系１４はマイクロプロセッサ２３により制御される。以上のうち各要素１３～１７は駆動手段の一部を構成している。

【００２１】２４はレチクル１の回路パターンを均一な照度で照明する照明系である。照明系２４は発振波長λ＝２４８．４ｎｍのレーザ光を放射するＫｒＦエキシマレーザを露光用の光源として具備している。照明系２４からのレーザ光はレチクル１と投影レンズ系５を介してウエハ９上に向けられ、ウエハ９上にレチクル１の回路パターン像が縮小投影されることになる。

【００２２】照明系２４は、後述する波長選択素子駆動制御系３２により発振波長が制御された光束を放射するレーザ光源２７を備え、レーザ光源２７からの光束により、コンデンサレンズ２５を介し、ミラー２６で反射させてレチクル１面上を均一に照明する。レーザ光源２７はレーザ共振器２８と波長選択素子２９を有する。３０は波長選択素子２９を駆動する波長選択素子駆動装置、３１は波長選択素子２９の角度を検出する波長選択素子角度検出器、３２は波長選択素子２９の駆動を制御する波長選択素子駆動制御系であり、これらの各要素は波長可変手段の一要素を構成している。

【００２３】マイクロプロセッサ２３はそのメモリ４０内に、２基の気圧センサ１９Ａおよび１９Ｂの平均の気圧計測値に基づいて、投影レンズ系５のレンズ系間における空気の相対屈折率変化量を求めるための計算式がプログラムされており、各々の計算式では気圧の予め決めた基準値からの変動量が変数となっている。そして、気圧変動に対応するために、処理すべきウエハが投影露光装置に搬入される度に気圧を測定し、この測定結果に基づいて投影露光波長を変化させて投影露光を行なうようにすることによって、気圧変動に対して投影光学系の像性能が常に良好に保たれるようにしている。

【００２４】メモリ４０には、２基の気圧センサ１９Ａおよび１９Ｂによって計測された気圧値が記録され、また、これらの気圧センサから得られた値に基づいて異常か否かを判断するための閾値Ａの設定情報、任意の時間間隔をおいてこれらの気圧センサによって計測された新旧の気圧値に基づいて異常か否かを判断するための閾値Ｂの設定情報、および気圧センサ１９Ａおよび１９Ｂの機差が登録される。マイクロプロセッサ２３は、これらのメモリ４０の情報と気圧センサ１９Ａおよび１９Ｂで計測された気圧値に基づいて気圧の異常を検知する。そして、異常の場合は、アラーム装置４１により警告を行なう。

【００２５】図３は、このような投影露光装置５３を複数備えた露光装置システムの概略を示すブロック図である。各投影露光装置５３は、ネットワーク５１を介して、集中管理装置５２に接続されており、双方のデータ授受ができるような構成となっている。集中管理装置５２は、同時刻において、各投影露光装置５３に対して気圧計測を指示するリモートコマンドにより、各投影露光装置に対して気圧計測を実行させることができる。そして、集中管理装置５２は、同時刻において各投影露光装置５３で計測された気圧値を各投影露光装置５３から受信し、それを集中管理装置内５２にあるメモリ５４に登録する。また、集中管理装置側５２は、メモリ５４に登録された同時刻における各投影露光装置５３の気圧値に基づき、事前に、各投影露光装置５３間における気圧計の機差を算出し、メモリ５４に登録する。各投影露光装置５３から最新の気圧値の問い合せを受けたときには、その投影露光装置５３に対し、最新の気圧値に前記各投影露光装置５３間の機差を加算した値を送信する。

【００２６】図２は、図１の装置の動作を示すフローチャートである。この装置において、気圧変動に対する補正は、ウエハ搬入時やフォーカス補正時などに実施される。また、装置未稼動状態の場合も考慮し、定期的に気圧計測を実施し、その結果をメモリ４０に登録するようにしている。

【００２７】図２に示すように、ジョブが開始されると（ステップＳ１０１）、まず、ステップＳ１０２～Ｓ１０４において、ウエハ搬入およびフォーカス補正を行なうとともに、ウエハ搬入時やフォーカス補正時に、２基の気圧計１９Ａおよび１９Ｂを用いて気圧計測を行なう。ただし、この２基の機差は、事前に測定してあり、オフセットとしてメモリ４０に格納して管理している。

【００２８】次に、ステップＳ１０５において、気圧計１９Ａおよび１９Ｂによって計測した気圧値を比較し、両者の計測値の差がメモリ４０に設定された閾値Ａ以上か否かを判定する。計測値の差が閾値Ａ以上であると判定した場合は、いずれかの気圧計が異常な状態にあると判断されるため、ステップＳ１１０へ進む。計測値の差が閾値Ａ以上でないと判定した場合はステップＳ１０６へ進む。

【００２９】ステップＳ１０６では、メモリ４０に記憶されている前回の気圧値を読み込んで、前回の気圧値と、ステップＳ１０４で計測した今回の気圧値との差が装置に設定されている閾値Ｂ以上であるか否かを判定する。前回の気圧値とは、ウエハ搬入時やフォーカス補正

時において、もしくは、一定時間間隔、例えば１０分間隔で計測された値のうちの最新の値である。そして、前回と今回の気圧値の差が閾値Ｂ以上であると判定した場合は、気圧計１９Ａおよび１９Ｂの双方が異常な状態であると判断されるため、ステップＳ１１０へ進む。前回と今回の気圧値の差が閾値Ｂ以上でないと判定した場合は、今回計測した気圧値は正常と判断されるため、ステップＳ１０７へ進む。

【００３０】ステップＳ１０７では、今回の気圧値、装置番号、および日時を、ネットワーク５１を介して集中管理装置５２へ送信する。集中管理装置５２は、これを受信すると、メモリ５４に登録する。集中管理装置５２は、このようにして、常に最新の気圧値を各投影露光装置５３から受信し、メモリ５４に記録している。

【００３１】次に、ステップＳ１０８において、ステップＳ１０４で計測した気圧値に基づいて焦点位置および投影倍率の補正を実行し、そして、ステップＳ１０９において回路パターンの露光を行ない、ジョブを終了する。

【００３２】一方、ステップＳ１１０へ進んだ場合は、アラームを出力する。次に、ステップＳ１１１において、集中管理装置５２に対し、メモリ５４に登録されている最新の気圧値の問い合せを行ない、最新の気圧値に各投影露光装置５３間の機差を加算した値を集中管理装置５２から受信する。次に、ステップＳ１１２において、受信した気圧値によって、ステップＳ１０４で計測した気圧値を置き換え、ステップＳ１０８へ進む。したがって、ステップＳ１０８およびＳ１０９では、置き換えられた気圧値に基づいて焦点位置および投影倍率の補正を行ない、回路パターンの露光を行なうことになる。

【００３３】このような処理を採用した理由は次のとおりである。気圧は、長期的には大きな変動はみられるが、短期的に大きく変動することはない。また、クリーンルーム内で生じる気圧変動は、そのクリーンルーム内の各投影露光装置においてもほぼ同様の気圧変動を生じさせるものと推測することができる。ところが、投影露光装置内において、ケーブル・コネクタの接触不良などの何らかのトラブルによってノイズが発生したりすると、気圧計がそのノイズを拾って誤動作し、短時間に１．５ｈｐａも変化することがある。このような変化は明らかに、誤動作とみなすことが可能である。

【００３４】そこで、本実施例では、計測して得た短期間における気圧の変動量をチェックし、変動量がある一定以上となった場合は、気圧計１９Ａおよび１９Ｂの異常とみなすようにしている。すなわち、異常を判断する際には、投影露光装置内の２基の気圧計１９Ａおよび１９Ｂによる計測値の差、および今回と前回の計測値の差を用いることにより、気圧の計測値の変動が計器自体の故障によるものか、または外的要因によるものかを判断するようにしている（ステップＳ１０５およびＳ１０６）。これは、その後の原因究明に役立つと共に、故障復帰までの時間を短くする一情報としての役割を担っている。

【００３５】しかし、気圧計１９Ａおよび／または１９Ｂが異常であると判断された時点ですぐに装置を停止させ、生産を停止させることは、生産性を低下させることに繋がる。その結果、生産予定を達成できないことになりかねない。そこで、本実施例ではさらに、装置の停止を回避させるために、一定期間、もしくは一時的に、他の露光装置の気圧値を代用して（ステップＳ１１１およびＳ１１２）、焦点位置補正および投影倍率補正を行なうことにより、処理続行を可能としている。

【００３６】［実施例２］上記第１の実施例では、集中管理装置５２は、各投影露光装置５３からの気圧値を登録し、最新の気圧値に各投影露光装置５３間の機差を加算した値を、問い合せのあった半導体露光装置５３に送信するようにしているが、この代わりに、本実施例では、図３の集中管理装置５２に気圧センサ５５を設け、全ての投影露光装置５３に対して、同一の気圧値を送信するようにしている。そして、集中管理装置５２に接続されている気圧センサ５５により計測された気圧値を、常に各投影露光装置５３に送信するか、各投影露光装置５３の気圧値が異常時のみ集中管理装置５２で管理している最新の気圧値を送信するかどうかを選択できる手段を備えており、その設定に従って各投影露光装置５３に気圧値を送信する。

【００３７】［実施例３］図４は、本発明の第３の実施例に係る半導体露光装置の外観を示す斜視図である。同図に示すように、この半導体露光装置は、装置本体の環境温度制御を行なう温調チャンバ１０１、その内部に配置され、装置本体の制御を行なうＣＰＵを有するＥＷＳ本体１０６、ならびに、装置における所定の情報を表示するＥＷＳ用ディスプレイ装置１０２、装置本体において撮像手段を介して得られる画像情報を表示するモニタＴＶ１０５、装置に対し所定の入力を行なうための操作パネル１０３、ＥＷＳ用キーボード１０４等を含むコンソール部を備えている。図中、１０７はＯＮ－ＯＦＦスイッチ、１０８は非常停止スイッチ、１０９は各種スイッチ、マウス等、１１０はＬＡＮ通信ケーブル、１１１はコンソール機能からの発熱の排気ダクト、そして１１２はチャンバの排気装置である。半導体露光装置本体はチャンバ１０１の内部に設置される。

【００３８】ＥＷＳ用ディスプレイ１０２は、ＥＬ、プラズマ、液晶等の薄型フラットタイプのものであり、チャンバ１０１前面に納められ、ＬＡＮケーブル１１０によりＥＷＳ本体１０６と接続される。操作パネル１０３、キーボード１０４、モニタＴＶ１０５等もチャンバ１０１前面に設置し、チャンバ１０１前面から従来と同様のコンソール操作が行なえるようにしてある。

【００３９】図５は、図４の装置の内部構造を示す図で

ある。同図においては、半導体露光装置としてのステッパが示されている。図中、２０２はレチクル、２０３はウエハであり、光源装置２０４から出た光束が照明光学系２０５を通ってレチクル２０２を照明するとき、投影レンズ２０６によりレチクル２０２上のパターンをウエハ２０３上の感光層に転写することができる。レチクル２０２はレチクル２０２を保持、移動するためのレチクルステージ２０７により支持されている。ウエハ２０３はウエハチャック２９１により真空吸着された状態で露光される。ウエハチャック２９１はウエハステージ２０９により各軸方向に移動可能である。レチクル２０２の上側にはレチクルの位置ずれ量を検出するためのレチクル光学系２８１が配置される。ウエハステージ２０９の上方に、投影レンズ２０６に隣接してオフアクシス顕微鏡２８２が配置されている。オフアクシス顕微鏡２８２は内部の基準マークとウエハ２０３上のアライメントマークとの相対位置検出を行なうのが主たる役割である。また、これらステッパ本体に隣接して、周辺装置であるレチクルライブラリ２２０やウエハキャリアエレベータ２３０が配置され、必要なレチクルやウエハはレチクル搬送装置２２１およびウエハ搬送装置２３１によってステッパ本体に搬送される。

【００４０】チャンバ１０１は、主に空気の温度調節を行なう空調機室２１０および微小異物を濾過し清浄空気の均一な流れを形成するフィルタボックス２１３、ならびに装置環境を外部と遮断するブース２１４によって構成されている。チャンバ１０１内では、空調機室２１０内にある冷却器２１５および再熱ヒータ２１６により温度調節された空気が、送風機２１７によりエアフィルタｇを介してブース２１４内に供給される。このブース２１４に供給された空気はリターンロｒａより再度空調機室２１０に取り込まれ、チャンバ１０１内を循環する。通常、このチャンバ１０１は厳密には完全な循環系ではなく、ブース２１４内を常時陽圧に保つために、循環空気量の約１割のブース２１４外の空気を空調機室２１０に設けられた外気導入口ｏａより送風機を介して導入している。このようにしてチャンバ１０１は本装置の置かれる環境温度を一定に保ち、かつ空気を清浄に保つことを可能にしている。また光源装置２０４には超高圧水銀灯の冷却やレーザ異常時の有毒ガス発生に備えて吸気口ｓａと排気口ｅａが設けられ、ブース２１４内の空気の一部が光源装置２０４を経由し、空調機室２１０に備えられた専用の排気ファンを介して工場設備に強制排気されている。また、空気中の化学物質を除去するための化学吸着フィルタｃｆを、空調機室２１０の外気導入口ｏａおよびリターンロｒａにそれぞれ接続して備えている。

【００４１】図６は、図４の装置の電気回路構成を示すブロック図である。同図において、３０１は装置全体の制御を司る本体ＣＰＵであり、マイクロコンピュータまたはミニコンピュータ等の中央演算装置からなる。３０２はウエハステージ駆動装置、３０３はオフアクシス顕微鏡等のアライメント検出系、３０４はレチクルステージ駆動装置、３０５は光源装置等の照明系、３０６はシャッタ駆動装置、３０７はフォーカス検出系、３０８はＺ駆動装置であり、これらは、本体ＣＰＵ３０１により制御されている。３０９はレチクル搬送装置、ウエハ搬送装置等の搬送系、３１０は気圧センサ、３１１は温度センサ、３１２は湿度センサである。

【００４２】３００は補助記憶装置３１４、ディスプレイ３１７、キーボード３１６、および外部記憶装置３１５を有するコンソールユニットであり、本体ＣＰＵ３１３にこの露光装置の動作に関する各種のコマンドやパラメータを与えるためのものである。すなわち、オペレータとの間で情報の授受を行なうためのものである。補助記憶装置３１４は、例えばハードディスクであり、内部にデータベースが構築されており、各種パラメータおよびその管理データ等が記録されている。外部記憶装置３１５としてはＦＤＤ（フロッピーディスクドライブ）やＭＯＤ（光磁気ディスクドライブ）といったものが考えられる。３１８はネットワークインターフェイスであり、通信を行なう場合のプロトコルとしてはＴＣＰ／ＩＰ等の標準的ネットワークプロトコルが用いられることが多いが、ＮｅｔＷａｒｅ等の一般的に普及しているプロトコルを用いてもかまわない。プログラムおよびデータは、外部記憶装置３１５からメディアに格納したデータを読み出して、補助記憶装置３１４に保存される。

【００４３】この半導体露光装置は、高精度な半導体露光をするために、装置内の気圧、温度、湿度等の環境値を一定に保たなければならない。しかし、これらの環境値は天候による気圧の変化やクリーンルーム内の室温、湿度の変化等の露光装置外の環境の影響を受けやすい。そのため、露光装置内のこれらの環境値が異常値を示したとしても、露光装置内の空調機等の環境をコントロール装置や、気圧センサ３１０等の計測センサの故障なのか、露光装置外の環境変化によるものなのかを即座に判断することが、従来は困難であった。

【００４４】そこで、本実施例では、図７に示すように、クリーンルーム４０１内に設置された同一機種の複数の半導体露光装置４０４をネットワークインターフェイス３１８を介して、ネットワーク通信網４０２で接続し、各露光装置４０４間で互いの気圧、温度、湿度等の環境値をチェックし合うようにしている。そして、全ての露光装置４０４の環境値が同じように変化した場合は、その環境値の変化は露光装置４０４外の環境変化に起因するものと判断してオペレータに露光装置４０４外の環境に異常が生じたことを知らせ、特定の露光装置４０４のみ環境値が変化している場合は、その露光装置４０４内に異常が発生したと判断し、オペレータにその露光装置４０４内で異常が生じたことを知らせる。また、

ある露光装置４０４における気圧、温度、湿度等の複数の環境値が他の露光装置４０４と異なる値を示した場合は、その露光装置４０４のチャンバの機能に異常が発生したと判断し、オペレータにその露光装置４０４内で異常が生じたことを知らせる。なお、半導体露光装置４０４は、図４～６を用いて説明したものである。

【００４５】図８は、このような処理を行なうための露光装置４０４の動作を示すフローチャートである。同図に示すように、処理を開始すると、ステップ５０１において、ネットワーク上にある全ての同一機種の露光装置４０４から一定時間毎に気圧、温度、湿度等の環境変化の影響を受ける環境値を取得し、ステップ５０２において、全ての露光装置の環境値が同じように変化しているかどうかを判定する。全ての露光装置４０４の環境値が同じように変化していると判定した場合は、ステップ５１０へ進み、露光装置外の環境が変化しているかまたは、露光装置外の環境制御設備に異常が生じている可能性が高いことをオペレータに知らせ、処理を終了する。例えば、全露光装置４０４の気圧が同じ割合で変化している場合は、天候の変化が起こっていると判断し、温度が同じ割合で変化している場合はクリーンルーム４０１の環境制御に異常が発生している可能性があると判断する。

【００４６】ステップ５０２において、全ての露光装置の環境値が同じように変化しているのではないと判定した場合は、ステップ５０３へ進み、他の露光装置と異なる環境値があるか否かを判定する。ここで、他の露光装置と異なる環境値はないと判定した場合はステップ５０１へ戻り、異なる環境値があると判定した場合は、ステップ５０４へ進む。ステップ５０４では、他の環境値についても他の露光装置と異なっているかどうかを判定する。他の環境値も異なっていれば、ステップ５０５において、露光装置内の環境制御装置に異常が発生したと判断し、ステップ５０７へ進む。そうでなければ、ステップ５０６において、その環境値を計測するセンサの異常であると判断し、ステップ５０７へ進む。

【００４７】例えば、ステップ５０３において露光装置内の温度が異常値であると判定した場合において、ステップ５０４において湿度も異常値であると判定したときは、ステップ５０６において空調をコントロールするチャンバ装置が異常であり、ステップ５０４において湿度は正常であると判定したときはステップ５０６において温度センサが異常であると判断する。

【００４８】ステップ５０７では、他の露光装置における環境値との差が一定値以内であるか否かを判定し、一定値以内であればステップ５０８へ進んで警告メッセージを表示し、一定値以内でなければステップ５０９においてエラーメッセージを表示してから処理を終了する。

【００４９】図９はウエハを吸着するバキューム圧値についての処理を示すフローチャートである。同図に示すように、処理を開始すると、ステップ６０１において、ネットワーク上にある全ての同一機種の露光装置から一定時間毎にバキューム圧を取得し、ステップ６０２において、全ての露光装置のバキューム圧が同じように変化しているかどうかを判定する。同じように変化していれば、ステップ６１０へ進み、クリーンルーム内のバキューム圧を制御するコンプレッサに異常が生じている可能性が高いことをオペレータに知らせ、処理を終了する。同じように変化しているのでなければ、ステップ６０３へ進み、露光装置内のバキューム圧が他の露光装置と異なる値を示したか否かを判定する。異なる値を示さなかった場合はステップ６０１へ戻り、異なる値を示した場合は、ステップ６０４において、バキューム配管圧が他の露光装置と異なるかどうかを判定する。異なっていれば、ステップ６０５において露光装置内のバキューム機構に異常が発生したと判断してステップ６０７へ進み、異なっていなければステップ６０６においてバキューム圧計測センサの異常であると判断してからステップ６０７へ進む。

【００５０】ステップ６０７では、他の露光装置とのバキューム圧の差が一定値以下かどうかを判定し、一定値以下であればステップ６０８において警告メッセージを表示して処理を終了し、一定値以下でなければステップ６０９でエラーメッセージを表示してから処理を終了する。

【００５１】＜デバイス製造方法の実施例＞次に上記説明した露光装置あるいは露光装置システムを利用したデバイス製造方法の実施例を説明する。図１０は微小デバイス（ＩＣやＬＳＩ等の半導体チップ、液晶パネル、ＣＣＤ、薄膜磁気ヘッド、マイクロマシン等）の製造のフローを示す。ステップ１（回路設計）ではデバイスのパターン設計を行なう。ステップ２（マスク製作）では設計したパターンを形成したマスクを製作する。一方、ステップ３（ウエハ製造）ではシリコンやガラス等の材料を用いてウエハを製造する。ステップ４（ウエハプロセス）は前工程と呼ばれ、上記用意したマスクとウエハを用いて、リソグラフィ技術によってウエハ上に実際の回路を形成する。次のステップ５（組立て）は後工程と呼ばれ、ステップ４によって作製されたウエハを用いて半導体チップ化する工程であり、アッセンブリ工程（ダイシング、ボンディング）、パッケージング工程（チップ封入）等の工程を含む。ステップ６（検査）ではステップ５で作製された半導体デバイスの動作確認テスト、耐久性テスト等の検査を行なう。こうした工程を経て、半導体デバイスが完成し、これが出荷（ステップ７）される。

【００５２】図１１は上記ウエハプロセス（ステップ４）の詳細なフローを示す。ステップ１１（酸化）ではウエハの表面を酸化させる。ステップ１２（ＣＶＤ）ではウエハ表面に絶縁膜を形成する。ステップ１３（電極

形成）ではウエハ上に電極を蒸着によって形成する。ステップ１４（イオン打込み）ではウエハにイオンを打ち込む。ステップ１５（レジスト処理）ではウエハにレジストを塗布する。ステップ１６（露光）では上記説明した露光装置または露光方法によってマスクの回路パターンをウエハの複数のショット領域に並べて焼付露光する。ステップ１７（現像）では露光したウエハを現像する。ステップ１８（エッチング）では現像したレジスト像以外の部分を削り取る。ステップ１９（レジスト剥離）ではエッチングが済んで不要となったレジストを取り除く。これらのステップを繰り返し行なうことによって、ウエハ上に多重に回路パターンが形成される。本実施例の生産方法を用いれば、従来は製造が難しかった大型のデバイスを低コストに製造することができる。

【００５３】

【発明の効果】以上説明したように本発明によれば、他の装置における測定結果をも参照して異常な状態での動作を防止するようにしたため、測定手段が異常な測定値を示した場合、その原因を的確に判断し、異常な状態下での動作の続行を的確に防止することができる。例えば、気圧の測定手段が異常な値を示した場合においても、異常値が露光装置内の空調機等の環境のコントロール装置や気圧センサ等の計測センサの故障なのか、露光装置外の環境変化によるものなのか等を適切かつ即座に判断して異常な値による誤った補正を防止するとともに、管理装置等から得られる最新の気圧値を代替として用いることにより、装置を停止させることなく、処理を続行することができる。

【００５４】また、管理装置により、最新の測定結果を各露光装置に供給できるようにしたため、各露光装置における所定の計測対象についての計測値が異常である場合には、その代替値として、登録してある最新の計測値をその露光装置に供給し、その露光装置の動作を停止させることなく、デバイス製造を続行させることができる。

【図面の簡単な説明】

【図１】　本発明の第１の実施例に係る投影露光装置の要部概略図である。

【図２】　図１の装置の動作を示すフローチャートである。

【図３】　図１の投影露光装置を複数備えた露光装置システムの概略を示すブロック図である。

【図４】　本発明の第３の実施例に係る半導体露光装置の外観を示す斜視図である。

【図５】　図４の装置の内部構造を示す図である。

【図６】　図４の装置の電気回路構成を示すブロック図である

【図７】　図４の装置を含む露光装置システムの概略を示すブロック図である。

【図８】　図７のシステムにおける露光装置の動作を示すフローチャートである。

【図９】　図７のシステムにおける露光装置でのウエハを吸着するバキューム圧値についての処理を示すフローチャートである。

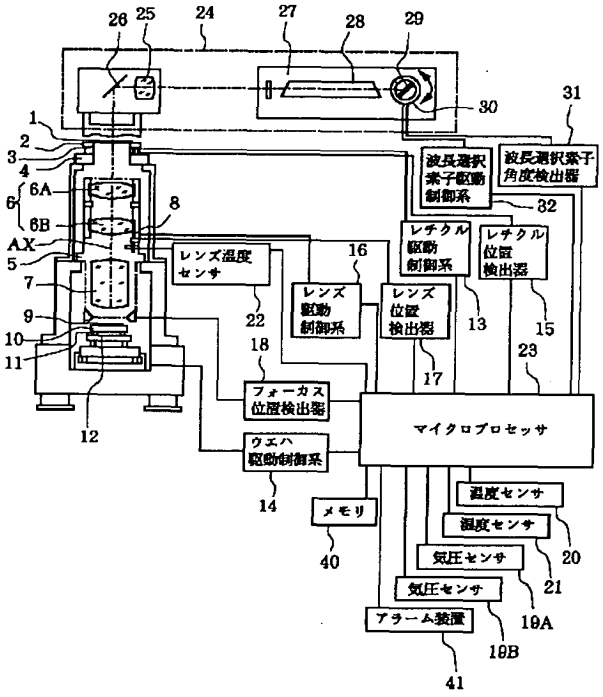
【図１０】　本発明の露光装置を利用できるデバイス製造方法を示すフローチャートである。

【図１１】　図１０中のウエハプロセスの詳細なフローチャートである。

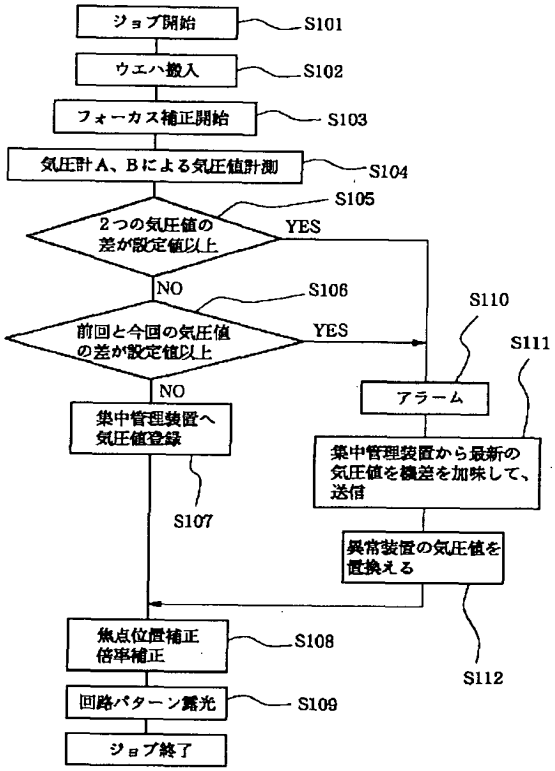
【符号の説明】

１：レチクル、２：レチクルチャック、３：レチクル駆動装置、４：レチクルステージ、５：投影レンズ系、６Ａ，６Ｂ：フィールドレンズ、７：レンズ系、８：レンズ駆動装置、９：ウエハ、１０：ウエハチャック、１１：ウエハ駆動装置、１２：ウエハステージ、１３：レチクル駆動制御系、１４：ウエハ駆動制御系、１５：レチクル位置検出器、１６：レンズ駆動制御系、１７：レンズ位置検出器、１８：フォーカス位置検出器、１９Ａ，１９Ｂ：気圧センサ、２０：温度センサ、２１：湿度センサ、２２：レンズ温度センサ、２３：マイクロプロセッサ、２４：照明系、２５：コンデンサレンズ、２６：ミラー、２７：レーザ光源、２８：レーザ共振器、２９：波長選択素子、３０：波長選択素子駆動装置、３１：波長選択素子角度検出器、３２：波長選択素子駆動制御系、４０：メモリ装置、４１：アラーム装置、５１：ネットワーク、５２：集中管理装置、５３：投影露光装置、５４：メモリ装置、５５：気圧センサ、３００：コンソールユニット、３０１：本体ＣＰＵ、３１３：コンソールＣＰＵ、３１７：ディスプレイ、３１０：気圧センサ、３１１：温度センサ、３１２：湿度センサ、３１８：ネットワークインターフェイス、４０１：クリーンルーム、４０２：ネットワーク通信網、４０４：半導体露光装置。

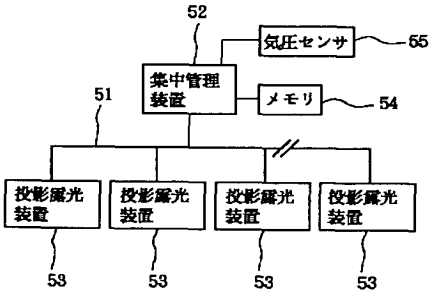
【図１】


26
25
24
27
28
29
30
31
1
2
3
4
6
6A
6B
8
AX
5
7
9
10
11
12
32
レンズ温度センサ
22
16
レンズ駆動制御系
レンズ位置検出器
17
18
フォーカス位置検出器
ウエハ駆動制御系
14
メモリ
40
マイクロプロセッサ
レチクル駆動制御系
13
レチクル位置検出器
15
23
波長選択素子駆動制御系
波長選択素子角度検出器
温度センサ
20
湿度センサ
21
気圧センサ
19A
アラーム装置
19B
41

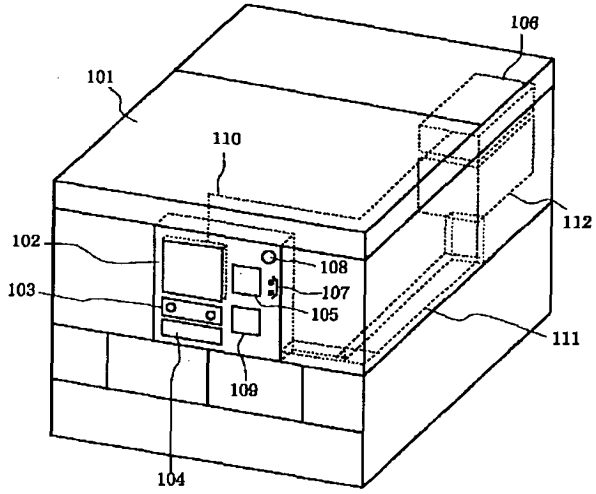
【図２】


ジョブ開始
S101
ウエハ搬入
S102
フォーカス補正開始
S103
気圧計A、Bによる気圧値計測
S104
S105
2つの気圧値の差が設定値以上
YES
NO
S106
前回と今回の気圧値の差が設定値以上
YES
NO
S110
アラーム
S111
集中管理装置から最新の気圧値を機差を加味して、送信
集中管理装置へ気圧値登録
S107
異常装置の気圧値を置換える
S112
焦点位置補正倍率補正
S108
回路パターン露光
S109
ジョブ終了

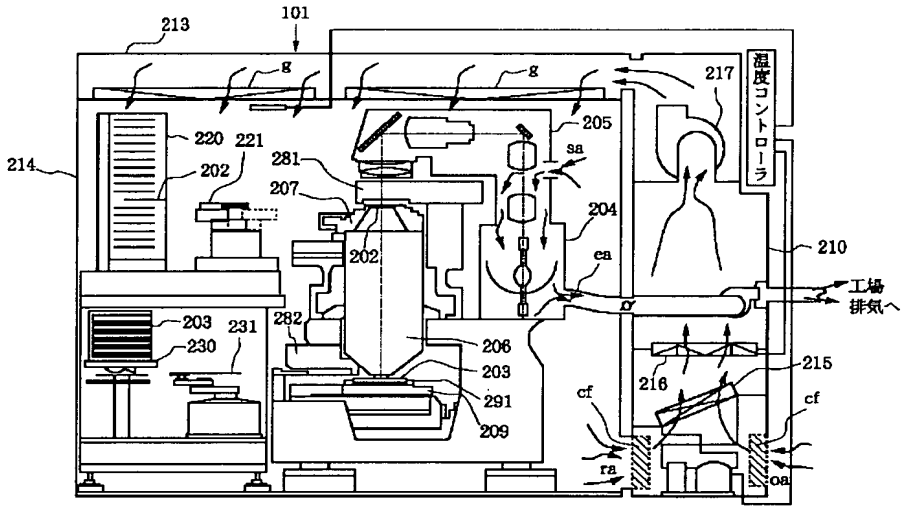
【図３】


52
気圧センサ
55
集中管理装置
51
メモリ
54
投影露光装置
投影露光装置
投影露光装置
投影露光装置
53
53
53
53

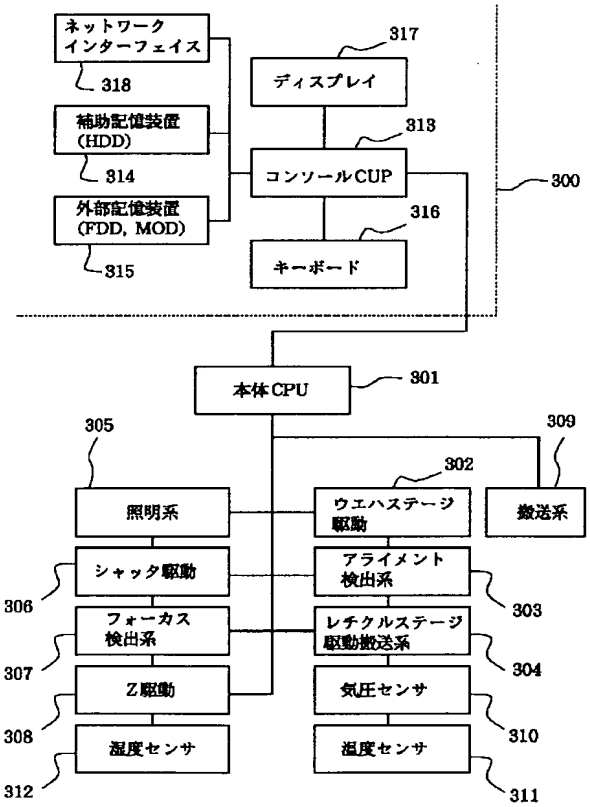
【図４】


106
101
110
112
102
108
103
107
105
111
109
104

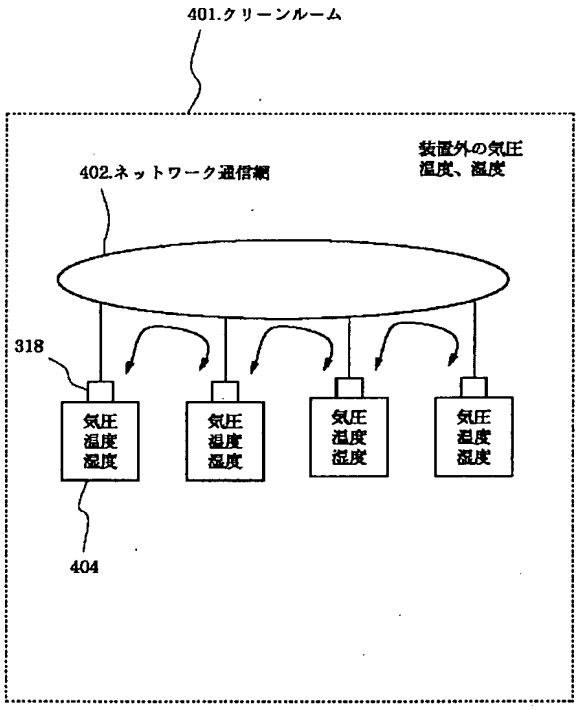
【図５】


213
101
g
g
217
温度コントローラ
205
220
221
sa
214
202
281
207
204
202
ea
210
工場
排気へ
203
231
282
230
206
203
291
209
cf
216
215
cf
ra
oa

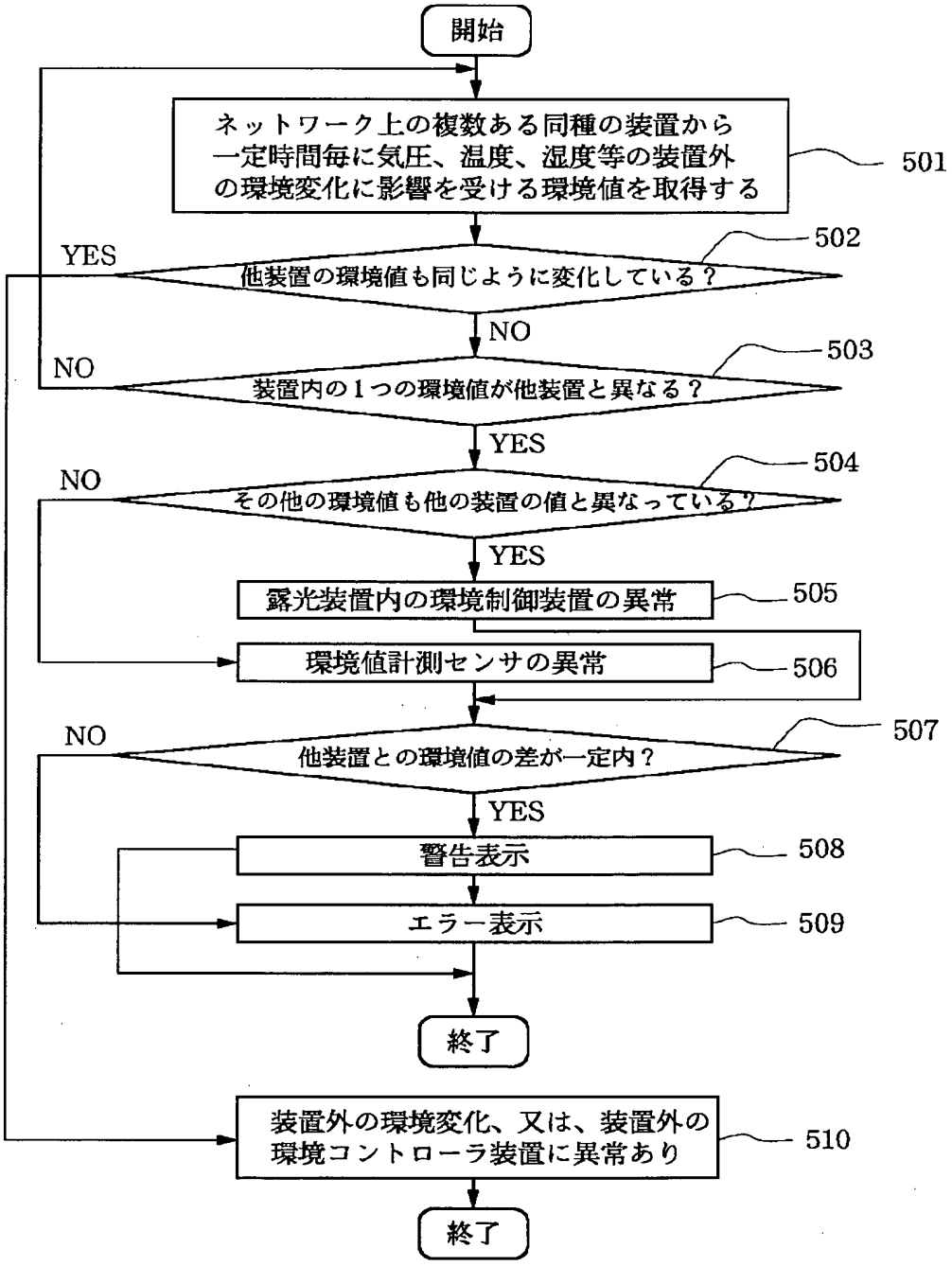
【図６】


ネットワーク
インターフェイス
318
317
ディスプレイ
補助記憶装置
(HDD)
313
314
コンソールCUP
300
外部記憶装置
(FDD, MOD)
316
315
キーボード
本体CPU
301
305
309
302
照明系
ウエハステージ
駆動
搬送系
シャッタ駆動
アライメント
検出系
306
303
フォーカス
検出系
レチクルステージ
駆動搬送系
307
304
Z駆動
気圧センサ
308
310
湿度センサ
温度センサ
312
311

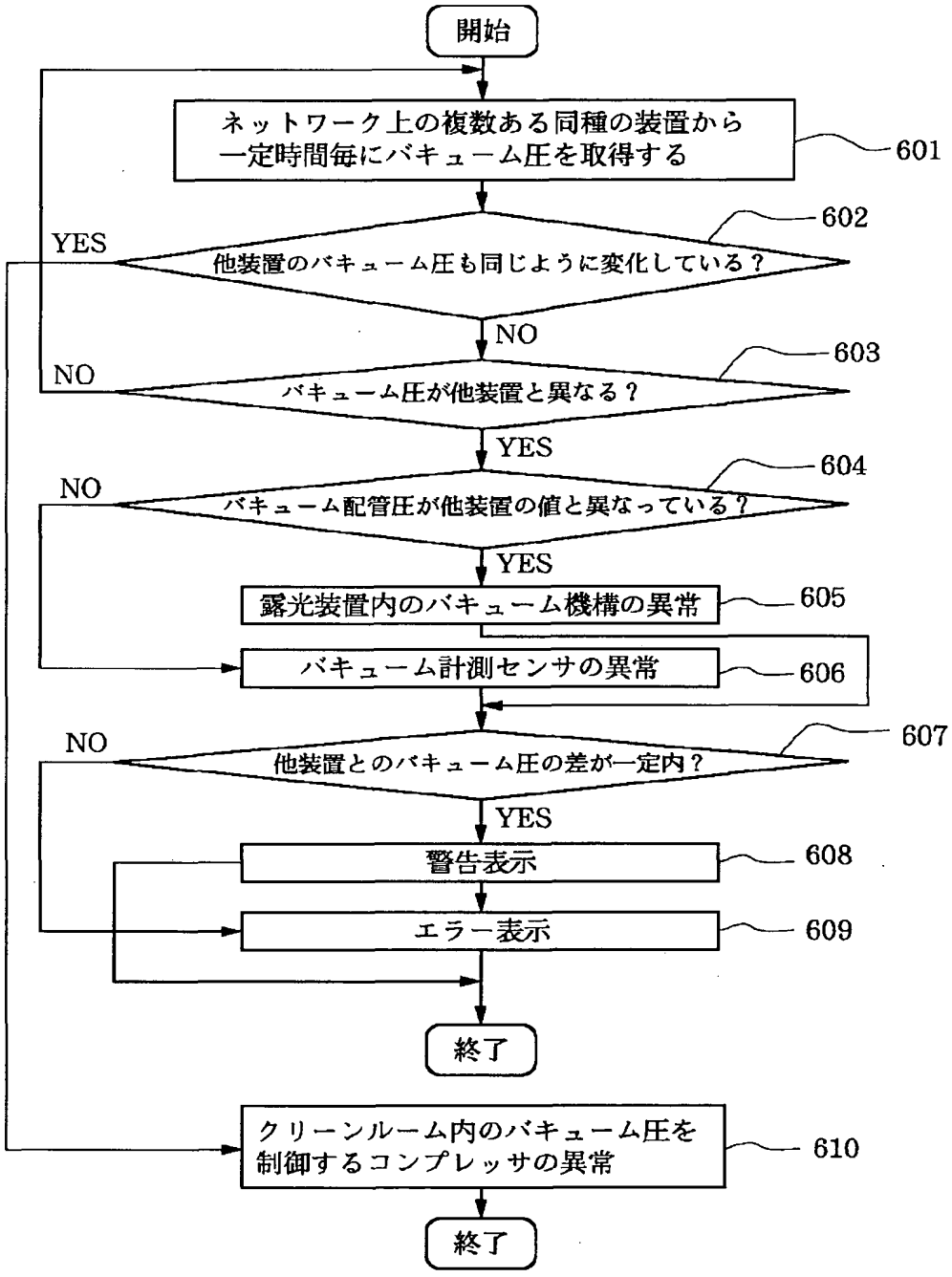
【図７】


401.クリーンルーム
装置外の気圧
温度、湿度
402.ネットワーク通信網
318
気圧
温度
湿度
気圧
温度
湿度
気圧
温度
湿度
気圧
温度
湿度
404

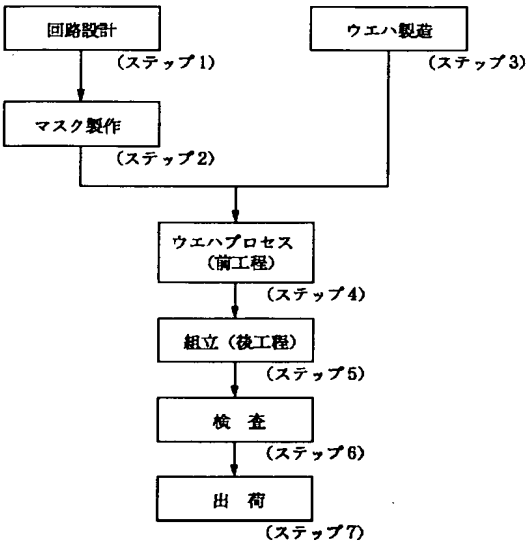
【図８】


開始
ネットワーク上の複数ある同種の装置から
一定時間毎に気圧、温度、湿度等の装置外
の環境変化に影響を受ける環境値を取得する
501
他装置の環境値も同じように変化している？
502
YES
NO
装置内の１つの環境値が他装置と異なる？
503
NO
YES
その他の環境値も他の装置の値と異なっている？
504
NO
YES
露光装置内の環境制御装置の異常
505
環境値計測センサの異常
506
他装置との環境値の差が一定内？
507
NO
YES
警告表示
508
エラー表示
509
終了
装置外の環境変化、又は、装置外の
環境コントローラ装置に異常あり
510
終了

【図９】

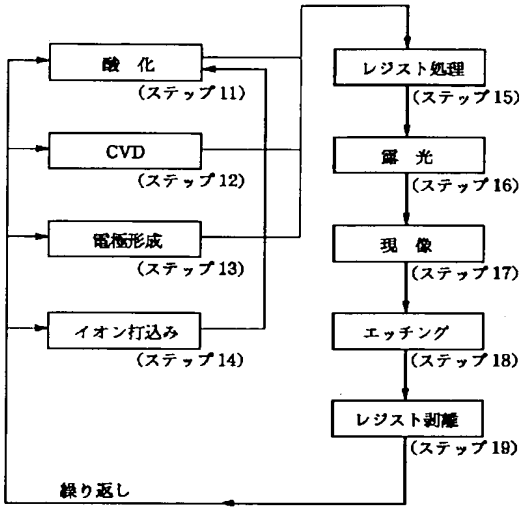

開始
ネットワーク上の複数ある同種の装置から
一定時間毎にバキューム圧を取得する
601
602
YES
他装置のバキューム圧も同じように変化している？
NO
603
NO
バキューム圧が他装置と異なる？
YES
604
NO
バキューム配管圧が他装置の値と異なっている？
YES
露光装置内のバキューム機構の異常
605
バキューム計測センサの異常
606
607
NO
他装置とのバキューム圧の差が一定内？
YES
警告表示
608
エラー表示
609
終了
クリーンルーム内のバキューム圧を
制御するコンプレッサの異常
610
終了

【図１０】



半導体デバイス製造フロー

【図１１】



ウエハプロセス